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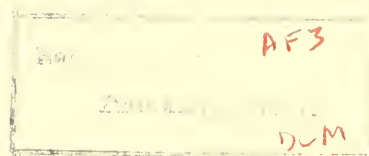
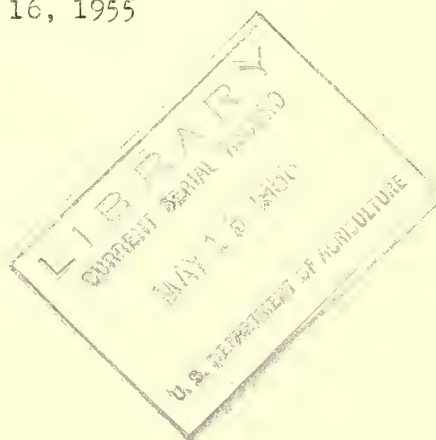
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Report of the
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TWELFTH SOUTHERN PASTURE AND FORAGE CROP
IMPROVEMENT CONFERENCE

Agricultural Experiment Station
of the

University of Tennessee
Knoxville, Tennessee

June 14 - 16, 1955



Report of the
TWELFTH SOUTHERN PASTURE AND FORAGE CROP
IMPROVEMENT CONFERENCE^{1/}

University of Tennessee
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^{1/} Reported by Paul R. Henson, Permanent Secretary, Southern Pasture and Forage Crops Improvement Conference, assisted by R. P. Bates, Samuel Roberts Noble Foundation, Ardmore, Okla., and R. D. Staten, Arkansas Agricultural Experiment Station, Fayetteville, Ark.

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June 24, 1955 - 9:30 A.M. The Conference was called to order by the Chairman, Dr. D. S. Chamblee, N. C. State College, Raleigh, N. C. Prof. L. N. Skold, of the host institution introduced the speakers. Dean J. H. McLeod, Dean of the College of Agriculture, welcomed the group to Tennessee.

Dr. Andrew Holt, Vice Pres., University of Tennessee, warmly welcomed the conference members to Tennessee. The requirements for leading a full and happy life, running a successful business, and of developing a successful conference were developed by Dr. Holt and were vividly contrasted to the "hound dog" type of living and doing. It is suggested that Prof. Holt be contacted for the very worthwhile details of his address.

Introduction of Members: The number of members in attendance from each state was as follows:

Alabama	4	North Carolina	11
Arkansas	1	Puerto Rico	1
Florida	4	South Carolina	2
Georgia	15	Tennessee	12
Indiana	4	Texas	5
Louisiana	1	Virginia	8
Kentucky	7	USDA	6
Mississippi	4	Total	83

Business Meeting: Dr. D. S. Chamblee, Chairman

Dr. Chamblee called attention to the fact that of the elected membership of the Executive Committee, only he remained. In February 1955 Dr. Chamblee appointed a Nominating Committee composed of G. B. Killinger, Chairman; P. R. Henson and R. C. Potts. In a letter to Dr. Chamblee, Dr. Killinger reported the Committee's action, with nominations as follows:

<u>Nominee</u>	<u>Vacancy</u>	<u>Expiration Date</u>
R. E. Blaser, Va.	3 years*	1958
W. W. Huffine, Okla.	4 " **	1959
P. B. Gibson, Ala.	Full term	1960

* Vacancy of P. C. Sandal, Ark. and ** L. V. Crowder, Ga.

Dr. Burton (Ga.) moved the nominations cease, seconded by Hanson(N.C.). Dr. Skold moved that the nominees be elected unanimously, seconded by Bennett(Miss.). The motion passed. Dr. Chamblee pointed out that Dr. Leasure, whose term of office expires in 1956, had left Tennessee since the nomination committee had been appointed. He announced that nominations to fill the unexpired term of Dr. Leasure were in order. Dr. F. G. Hogg was nominated and elected unanimously. In accordance with the Executive Committee procedure, Dr. Chamblee announced that Dr. Blaser will be Chairman next year. The Executive Committee for 1956 is as follows:

The Executive Committee for 1956 is as follows:

P. G. Hogg, Miss.	1956
D. S. Chamblee, N. Car.	1957
R. E. Blaser, Va.	1958, Chairman
W. W. Huffine, Okla.	1959
P. B. Gibson, Ala.	1960
R. H. Lush, Tenn.	Dairy Husbandry
H. H. Leveck, Miss.	Animal "
P. R. Henson, Permanent Secretary	

In a discussion of the meeting place for next year, Chairman Chamblee read from the 1954 Conference Report of future meeting places. According to last year's report, the group had been invited to Mississippi in 1956 and to Experiment, Ga., in 1957.

Dr. Chamblee read invitations from Dr. Cowart of the Georgia Agricultural Experiment Station, Experiment, Ga., to meet there in 1956 or 1957. An invitation from Dr. Clay Lyle, Director of the Mississippi Agricultural Experiment Station, to meet either year at State College, Miss., was also read. Chairman Chamblee asked that the decision as to the meeting place for next year be delayed until the close of the conference. Meeting adjourned.

Tuesday, June 14

1:30 P.M. Group I - Pasture Evaluation Techniques, First Session
H. L. Lucas, N. C., Chairman

Are we learning anything from agronomic small plots?
T. H. Taylor, Ky.

In recent years more effort is being made to evaluate forage plants through the use of animals. In most circumstances, the animal method can be used only to a limited extent because of the expense involved in obtaining adequate control over the variables. Consequently, small agronomic plots are commonly used for the selection of treatments to be tested under grazing conditions. The worth of small plot trials may be gauged by the success in approximating the direction to move on a large field basis.

I. Things we have learned from small plot trials.

1. We have learned through field trials some of the desirable agronomic characteristics of forage species, varieties and strains. Kenland red clover, Coastal Bermuda grass, Atlantic alfalfa may serve as examples.
2. We have learned the approximate fertilizer requirements for good plant growth of certain forage species on certain soil types. Some information is available as to the rate of fertilizer to apply in establishing and maintaining a grass-legume mixture for grazing or winter feed purposes.

3. We know with workable accuracy how frequently alfalfa may be harvested and yet maintain the stand and obtain a good quality feed. Similar knowledge is being accumulated on other plants such as orchardgrass, tall fescue, Bermuda grass, red clover and Ladino clover.
4. We are learning something about compounding artificial seed mixtures. Considerable knowledge is now available on the compatibility of various species growing in association. Examples: alfalfa-orchardgrass, alfalfa-bromegrass, orchardgrass-Ladino clover and Bermudagrass-small grain.
5. We are gaining knowledge at a rather rapid pace on how to establish desirable species in existing vegetation. Examples: Small grains sown in Bermudagrass sods, Ladino clover sown in orchardgrass sod. This work has progressed to a point that certain recommendations may be made.

II. Suggested areas of future investigation using the small agronomic plot.

1. The dry matter production of a theoretical 12 months roughage program for livestock using various plant species in suitable combinations and rotations.
2. The growth behavior of certain forage plants using supplemental water vs. no supplemental water at various levels of fertility.
3. Establishment of legumes in grass sods under grazing conditions.
4. The behavior of various plant species grown alone and in combinations under different intensities of actual grazing and clipping conditions.
5. The relative palatability of different forage plants grown alone and in combinations at different stages of growth and under different levels of fertility.
6. The digestibility of various forage plants grown in pure stands and in associations, at different levels of fertility and at different stages of growth.

In summary, agronomic small plot trials are invaluable aids to the understanding of the growth characteristics of forage species and their ability to persist and produce in swards with various managements and fertilizer practices. It appears feasible to extend the use of small plots to include the effects of grazing animals on seedling establishment, dry matter yield, botanical composition, and persistency of stands. Also reliable information as to the relative palatability and digestibility of forage plants is well within the scope of the small agronomic plots.

DISCUSSION:

Hogg: How small a plot can you graze with large animals?

Taylor: About 30' by 50' with 3 animals for 1/2 day - experience in animal adjustment is necessary.

Hogg: What data are derived from the animals?

Taylor: The animal is used only as a tool to obtain the effects of trampling, periodic harvesting, droppings and differential grazing. Effects on the composition of the sward are being measured.

Chamblee: How often are the plots grazed?

Taylor: Two weeks to 28 days. Mower strips are used to estimate yields.

De Vane: What size plot should be used in palatability studies and how many animals should be used?

Taylor: The plots should be big enough for the animals to lie down in and to browse in - 15' x 20' maybe. The animals should not be too hungry, so that they will graze in a normal way.

Blaser: One can reduce the animal variance by increasing the animal numbers or by using a few animals through the several trials during a season.

Petersen: How good is dry matter yield as an estimate of beef or milk production? No answer.

Chamblee: How is Ladino established in old stands of orchard and fescue?

Taylor: Four heavy discings will not materially damage the fescue, but will open up the sod enough to be able to establish the clover.

What do we learn from cage and mower strip measurements? ✓
W. R. Langford and E. F. Schultz, Ala.

There are two methods of determining the amount of forage produced under grazing. These are the mower strip technique and the cage difference method. Under rotational grazing the mower strip is preferred because: (1) samples can be taken faster, (2) less labor is required, and (3) data from long, narrow strips are less variable than data from square cages. However, the mower strip method is not suitable for determining yield under continuous grazing or even under rotational grazing where the grazing period lasts several days at a time because growth made during the grazing period is ignored. The cage difference technique can be used to determine yield under continuous grazing.

The Alabama Experiment Station initiated a grazing experiment in 1952 on Norfolk sandy loam soil at the Wiregrass Substation to evaluate common Bermuda, Coastal Bermuda, and Pensacola Bahiagrass in mixtures with white clover. Bahiagrass and common Bermuda are studied at rates of 0, 80, and 160 pounds of nitrogen per acre annually. Coastal Bermuda grass is studied at the same nitrogen level and at a 320 pound per acre

rate. Clover has failed each year and the pastures have consisted of almost pure stands of grass. Data are collected on forage yield, changes in botanical and chemical composition of the sward, changes in soil fertility, and on steer performance. Forage yield is determined by the cage difference technique. Ten cages are used on each 1-3/4 acre paddock.

Analysis of the data on forage production and steer performance during the first two grazing seasons shows the following relationships:

Forage production increased with increasing fertility. Excepting one of the non-nitrated Bahiagrass paddocks in 1954, steer gains increased with increasing fertility. Again excepting the same non-nitrated Bahiagrass paddock in 1954, steer gains increased with increased forage production. The analysis reported herein either ignores the Bahiagrass plot with the aberrant steer gain or uses a missing plot estimate.

Regression lines fitting pounds of steer gain per acre to pounds of forage produced per acre were prepared for each grass each year. Within each year the relationship was the same within each grass, and furthermore, it was the same from grass-to-grass as from plot-to-plot within each grass. Hence the estimates were pooled for each year to find an average estimate for the year. The relationships were different for the two seasons. Each year the regression lines indicated some steer gain on pastures producing no forage.

In an effort to find a more useful and realistic relationship between steer gain and forage production, the yield of forage was transformed to the logarithm of pounds of forage per acre. Again the individual regressions for each grass each year were similar and were also the same as the relationship from grass-to-grass, hence again the estimates were pooled to obtain an average relationship for each year. On testing it was found that the relationship was the same within each year, though not the same as the relationship from year-to-year.

Since the logarithmic relationships showed no steer gains on pastures without forage, and the individual and yearly regressions of steer gain on log pounds of forage were of the same order of magnitude as the individual and yearly regressions of steer gain on pounds of forage, and the logarithmic relationships were similar and could be averaged for the two years whereas the original relationships were different, the relationship of steer gain to log pounds of forage produced was accepted as the better and more useful relationship.

The average relationship of beef to log pounds of forage may be expressed as: $Y = -2142 + 657 \log_{10} X$, or by the statement that 1818 pounds of forage will maintain one steer on one acre and each time the yield is doubled the gain will be 198 pounds of beef per acre. With 95% confidence, a beef yield within the range of 167 to 229 pounds may be expected each time the forage yield is doubled from 1818 pounds per acre.

The relationship between yield of beef and log pounds of forage is of such nature that the residual variation about the regression line is of the same order of magnitude as the error variance of beef yields in conventional analysis of variance. This indicates that differences in

yield of beef due to treatments are defined as precisely by a knowledge of the amount of forage produced as by actually grazing and weighing steers. Future evaluations of treatments on these grasses may be made by determining the forage yield on small plots under grazing, using either the cage difference technique or the mower strip method, depending on the system of grazing.

DISCUSSION:

Lucas: Were correlations made with the small-plot yields?

Langford: These correlations have not been computed yet.

Engel: How do pounds of forage compare with pounds of corn for beef yield? Could not T.D.N. production be used?

Langford: This has not been done in this experiment.

Blaser: This appears to be one of the few cases where such high correlation has been observed.

Langford: It may be due to the species under study.

Woodhouse: What size cages were used?

Langford: Ten 4' x 4' cages in 1-3/4 acres.

Woodhouse: The cage number is high enough to reduce variability and the stand and growth of these species may be more uniform over the pasture than is usually encountered. Usually not enough cages are used.

Anthony: The palatability and consumption were relatively uniform.

Lucas: There is a possibility that there is little selectivity of grazing possible with these species.

Mott: What reasoning was used to arrive at the log transformation?

Langford: No biological reasoning -- it gave a better fit.

Chamblee: How would the results be used in future evaluation?

Langford: One would turn to small grazed plots with clipping techniques to measure yields.

Bloat and grass tetany, B. F. Barrentine, Miss.

Bloat and grass tetany seriously interfere with forage crop evaluation if they occur. The interference due to bloat on legume pastures depends upon the occurrence of fatalities. Bloat without fatalities presents the possible effect of bloat on milk production or rate of gain. Grass tetany rarely ever presents a problem except in the case of lactating cows or ewes, which are not receiving supplemental feed.

Experimental bloat is produced by grazing steers on a pure stand of Ladino clover. The steers graze for one and one half hours morning and afternoon. They are held in dry-lot with shade, salt, and water but no feed, until grazing time. Animals that bloat regularly are selected.

Experimental grass tetany is produced by grazing ewes with lambs 2 to 3 weeks old on short grazed oat forage. Serum magnesium values are used as the criteria.

Various theories as to the cause of bloat and grass tetany will be discussed.

DISCUSSION:

Blaser: Why are some animals chronic bloaters?

Barrentine: All animals will bloat sooner or later; it may take longer for some animals to bloat. The tendency to bloat will change from time to time and from animal to animal. Some may wonder why we used the twice-a-day short period grazing. It was because we got many more cases of bloat. The amount of clover eaten is a minor factor in causing bloat and most animals will not bloat after a 24-hour fast.

Question: Why do you do these studies?

Barrentine: To evaluate various possible remedies for bloat.

Question: Have you tried any preventive measures?

Barrentine: Yes, without success.

Question: Can bloat be induced by feeding cut forage?

Barrentine: Yes, but the quantity fed is not a factor.

Blaser: Does time of day affect bloat?

Barrentine: Apparently there is little difference between morning and afternoon.

Question: Would you define again the conditions producing grass tetany?

Barrentine: Apparently any forage grass grazed short, especially under the conditions prevalent in the Black Belt of Mississippi and Alabama. It only occurs during certain seasons of the year. Both bloat and grass tetany are caused by multiple factors, no single factor is responsible.

Huffine: What soil factors influence grass tetany?

Barrentine: High lime and high pH appear to have a strong influence.

Pasture forage must be considered and investigated as any other feed for livestock as a source of energy, protein, minerals and other factors balanced or unbalanced in varying proportions. Forage evaluation with livestock is thus basically a feeding trial and the results obtained will conform to the basic laws of animal nutrition. The fact that animal nutrition is not an exact science, and, the many areas in nutrition in which knowledge is either missing or scant, can only mean that forage evaluation cannot at present be an exact science. This should not preclude continuing attempts for forage evaluation so long as the known principles of nutrition are used and each new advance in nutrition is added to the working techniques.

The Value of Forage Evaluation

Why bother with forage evaluation? From a purely scientific point of view, we are interested in the subject because a vast number of unknowns are contained in it. From a practical point of view, it holds vast possibilities for increasing the economic efficiency of livestock production. The following theoretical example (the values used were taken from experimental results at this station) illustrates both the scientific and practical reasons for forage evaluation. A farmer has set as a goal the production of 5000 pounds of milk per acre. In field A he has a forage that will carry 3.5 cows per acre for a period of 72 days. In field B he has a forage that will carry two cows per acre for the same period. The only difference in the feeding value of the two forages is a 10 percentage point spread in dry matter digestibility. Using the expected rate of forage intake and milk production for such forage materials, we have calculated the results that could be expected from such forages. In table 1 the comparative results are listed.

- (1) The increased amount of forage required to maintain the extra 1.5 cows on pasture A.
- (2) The vast difference in the two forages due to an increase of 10 percentage points in digestibility. (Supported by research).
- (3) Effect of forage digestibility on both intake and level of production.
- (4) The completely erroneous picture which would have been obtained had only milk produced per acre been considered.

Table 1

Pasture A 6520 lb. dry matter/acre 60% TDN 5040 lb. milk/acre

Production limited by pasture quality to 20 lb. per cow per day

3.5 cows per acre	72 grazing days	22.7 lb. dry matter intake/cow/day
TDN for maintenance	2304 lb	59%
TDN for production	1613 "	41%
Total TDN	3917 lb.	

Pasture B 3950 lb. dry matter/acre 70% TDN 5040 lb. milk/acre

Production limited by pasture quality to 35 lb. per cow per day

2 cows per acre	72 grazing days	27.4 lb. dry matter intake/cow/day
TDN for maintenance	1152 lb.	42%
TDN for production	1613 lb.	58%
Total TDN	2765 lb.	

With this practical example before us, let us proceed to discuss the reason for this difference and try to define and fractionate forage quality into measurable factors.

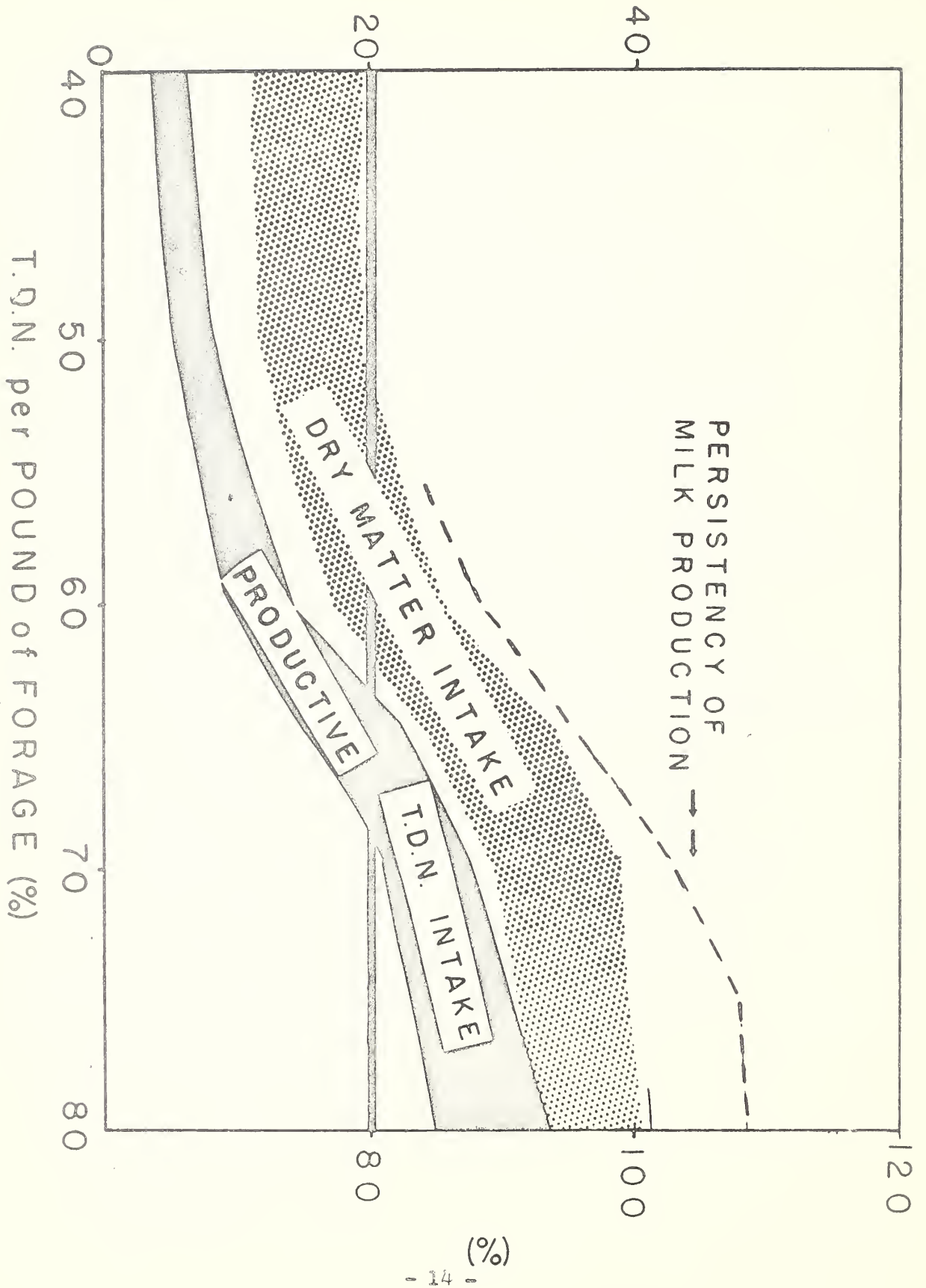
What is Forage Quality

Forage quality has been defined as the quantity of animal production obtained per unit of dry matter consumed. This definition obviously leaves much to be desired. For those with a mathematical mind forage quality could be defined by the following equations:

1. (lb. milk/day) X (no. days) = milk per acre
2. (lb. TDN intake/day) X (value of lb. TDN) = (maximum lb. milk/day)
3. (Productive TDN intake/day) X (no. days) = milk per acre

Obviously this approach gives some consideration to the factors involved but it leaves many unanswered questions.

P O U N D S



It would seem that the logical approach would be to create forage conditions which would result in measurable levels of animal production and then attempt to describe mathematically the forage condition which is correlated with the observed level of response.

In a recent review on ruminant nutrition, Huffman^{a/} said "The nutritive value of roughage depends on the digestibility, appetite (which depends on the rate of rumen digestion of celluloses and hemicelluloses), and the balance of nutrients made available to the tissues of the animal."

Forage Digestibility

The most informative of the measures currently available for forage evaluation is the dry matter digestibility. As will be seen, forage value seems to move up and down with changes in digestibility. Thus the use of indicators to determine digestibility may be one of the more valuable tools available in an evaluation program. Although dry matter digestibility by itself does not always correlate well with animal response, it does provide the basic data which can be used to correct for differences in intake and feeding value to arrive at a clear picture of the ration available for the animal.

The fact that a pound of TDN at one level of digestibility is not necessarily equal to a pound of TDN at another level has long been recognized. From the many experiments with forage conducted by Van Wyk^{b/} we have calculated the relative metabolizable energy value of a pound of TDN at five levels of dry matter digestibility. These values are shown in table 2. In this data the correlation between therms of metabolizable energy per 100 pounds of forage dry matter (Y) and dry matter digestibility (X) was $r = 0.985$. The regression equation between the two was $Y = -3.74 + 1.70X$.

Table 2

Dry matter dig. %	Metab. energy per 100 lb. Therms	Metab. energy per lb. TDN Therms
80	127	1.59
70	110	1.57
60	93	1.55
50	76	1.53
40	59	1.48

a/ Huffman, C. F., Ruminant Nutrition. Annual Review of Biochemistry. 22. 1953.

b/ Van Wyk, H.P.D. The Nutritive Value of South African Feeds. Dept. of Agr. Union of South Africa. Science Bull. 298. 1951.

If we project the two items of forage digestibility and metabolizable energy into feeding problems, we arrive at some interesting values. In table 3 are calculated data for the performance of an 1100-pound cow calculated by the two systems. The calculated production under the metabolizable energy system is much closer to the values found in feeding trials than those calculated from TDN.

Table 3

D.M. dig. %	D.M. intake per 100 lb.	lb. milk above maintenance TDN system lb.	M.E. system lb.
70	3.5	57	27
60	3.0	34	16

Dry Matter Intake

Many workers still use the terms palatability, appetite and intake as though they were synonymous. Although all are important in forage evaluation, it is important to distinguish the difference between them. For purposes of discussion, the terms may be defined as follows:

- a) Palatability - an external factor such as odor, position, unpleasant taste, presence of thorns, etc., which influences the acceptability of the forage to the animal.
- b) Appetite - an internal factor such as bulk, rate of digestion, consistency of rumen mass, etc., which influences the animal desire for feed.
- c) Dry matter intake - the rate of consumption which results from the influence of palatability and appetite at a given condition of forage availability.

The effect of palatability on forage intake is difficult to measure. Not only is there a between-plant difference in palatability but there may be a within-plant and within-day palatability. Animals will frequently consume a forage at one stage of maturity but not at another. Close observation of animals will show that they consume different plants one day than they do another. Just as humans tire of a single diet, so apparently do cows when given a choice. However, humans will seldom choose a food which they dislike as a means of changing their diet and it may be that it is here that palatability could be measured.

When forages of equal palatability and accessibility are studied, the many factors affecting appetite are free to express themselves. In general, dry matter intake follows the ups and downs of dry matter digestibility. While it is true that animals will generally consume even poor quality forages, high levels of intake are associated with high quality forage.

Another factor uncovered by the use of indicator techniques is the concept of "luxury consumption". Animals with a low production potential may consume as much feed as higher producing animals. In such cases the resulting rate of animal response to a given forage condition may be underestimated. In this connection, however, a note of warning should be issued. Before the animal is accused of "luxury consumption" the effect of plane of nutrition, relative balance of the ration and the possibility of the presence of some limiting factor such as a nutrient deficiency should not be overlooked.

It is here that the use of indicators to determine forage intake have been found of great help in forage evaluation. With indicators it is possible to study the effect of changes in forage quality on intake.

Ration Balance

It has long been recognized that the balance of nutrients in a ration exerts a profound effect on the net energy value of the ration. In ruminants this factor has received little attention. In such non-ruminants as the chicken it has received considerable attention and accounts, in a large measure, for the ever increasing efficiency with which these classes of livestock convert feed into animal products. This factor points out a very necessary consideration in forage evaluation. If a forage is fed without supplement it is evaluated as a single feed. However, the resulting value tells little of the value of the same forage in a feeding program which includes a supplemental feed. Consideration of the value of a forage or a forage condition as a part of a feeding program is as essential as determining its value as a single ration component.

One item of particular concern to those interested in evaluating forages with dairy cows is the ability of high quality forage to stimulate milk production. At present the exact nature of this stimulation is unknown. There are at least three accepted explanations.

1. The stimulation is due to improved ration balance. (Either for the cow or the rumen microorganisms)
2. The stimulation is due to estrogen-like factors.
3. The stimulation is due to an increase in net energy or change in ratio of organic acid production in the rumen.

The most likely answer is that all three factors are capable of exerting an influence. One factor that is of interest is the ability of small quantities of excellent forage to stimulate the rate of milk flow. This is contrasted with the effect of poor forage which may result in a decrease in milk production but an increase in body weight.

A fundamental difference between a high producing dairy cow and a beef steer in their response to type of forage is evident here. On high quality forage the dairy cow will produce milk at the expense of body weight but on low quality forage the cow may reverse the trend. The beef steer gains weight rapidly on the same type forage which results in excellent milk production. On the forage of lower quality the beef steer has a slow rate of gain while the producing dairy cow increases her body weight but decreases in milk production. Thus there are four pasture conditions which are encountered in forage evaluation with dairy cows. These are

summarized briefly in table 4. Obviously the conditions are far more complicated than the simple diagram in the table. They may be useful, however, as a starting point for investigations into ration balance.

Table 4			
Pasture type	Body weight change	Milk production change	Remarks
1	+	+	Adequate nutrient intake Stimulating factors present
2	-	+	Inadequate nutrient intake Stimulating factors present
3	+	-	Adequate nutrient intake Stimulating factors absent
4	-	-	Inadequate nutrient intake Stimulating factors absent

Do Indicator Techniques Have a Future?

It would seem that the future of indicator techniques is very bright. It is realized that a knowledge of dry matter intake and digestibility is only part of the picture; hence, in future work they can be used as tools for obtaining complete information. A doctor does not diagnose anemia only on the basis of a hemoglobin value, however, the hemoglobin value may give a clue to the real difficulty. Similarly, forages cannot be evaluated by intake and digestibility trials alone. The knowledge furnished by such trials is obviously the starting point in evaluation and in the absence of such information a complete evaluation is impossible.

DISCUSSION:

McIlvain: What is the greatest difference in percent digestibility in common grasses at the same stage of maturity?

McCullough: There is probably not much difference. The productive value may be very different although digestibility may be the same.

McIlvain: Are there possibilities of changing the digestibility of a grass by supplemental feeding?

McCullough: This is hard to know because once the supplement is added, the digestibility of the components cannot be distinguished. There is evidence, however, that addition of some factors such as alfalfa ash, will increase the digestibility of forages.

What are we learning from the study of grazing animal behavior
and from palatability studies? W. A. Hardison, Va.

The study of grazing animal behavior is not new. In 1797, Anderson observed the grazing habits of cattle and as a result of his observations, recommended that a system of rotational grazing be followed. Much interest has recently been shown in the behavior of the grazing animal as evidenced by the reviews by Tribe and Hancock.

As a result of the numerous studies conducted in recent years, much has been learned about the animal's behavior while grazing and about the many factors which influence his behavior. For example, it is known that during a 24-hour period the animal spends about 6-9 hours grazing, 7-9 hours ruminating, 3-6 hours loafing and 9-10 hours lying down, and that these activities are affected by such factors as weather, quantity and quality of herbage, management of pasture and animals and heredity. Of the "external" factors influencing grazing behavior, quantity and quality of herbage appear to be the most important. In general, abundant high quality forage decreases both grazing and ruminating times, while these activities occupy more of the animal's time when abundant forage of mixed or poor quality is available. Grazing time is also increased when forage is scarce regardless of the quality. Thus, it would seem that in order to obtain maximum production with a minimum expenditure of energy on the part of the animal, abundant high quality herbage should be provided as much of the time as possible. And yet, as has been pointed out by Hancock, this practice may not result in the highest net returns since animals grazing such a pasture are quite susceptible to such disorders as scours and bloat and frequently lose weight. The theoretical feed requirement for milk production is reported to be the most important "internal" factor affecting grazing time.

Since animals adapt their grazing habits to new or adverse conditions quite rapidly, it would seem that grazing behavior studies can be of only supplemental value in the overall problem of pasture evaluation. Furthermore, because of the variability among animals, erroneous and misleading results may be obtained unless observations are made on a large number of individuals over a considerable period of time.

Studies on palatability and selective feeding date back even earlier than studies on grazing behavior and, although the importance of palatability in animal nutrition is recognized, the "why" of selective feeding is still obscure.

Some believe that the animal has an inherent ability to distinguish between good and bad and to choose foods in accordance with nutritional needs. The animal populations which have survived over the ages in the wild state may be cited as evidence for this belief. On the other hand, it is difficult, if not impossible, to explain why animals will consume paint and die of lead poisoning, or lubricants capable of producing hyperkeratosis.

Food selection is influenced by various factors, some of which are associated with the food, some with the animal and others apparently with neither. Thus, it is impossible to ascribe a definite degree of palatability to particular plant species or mixtures.

The significance of selective grazing in the evaluation of pasture herbage is clearly shown in recent work in which it was found that the grazing animal selected herbage higher in crude protein, ether extract and mineral matter and lower in crude fiber than the whole plant available for consumption. Furthermore, all of the proximate constituents of grazed herbage were more digestible than those in herbage clipped from the same source. This investigation demonstrates that the chemical composition of clipped herbage is an unreliable index of the chemical composition of herbage selected by the grazing animal. Also, the digestibility of clipped herbage is of uncertain value and may be quite misleading in regard to estimating the value of pasture under grazing conditions.

DISCUSSION:

McIlvain: What makes appetite?

Engel: Low blood sugar is only one factor in a complex. There is known to be an appetite center in the brain.

Engel: To what extent should we allow selective grazing?

McCullough: That should depend upon what problem you are studying.

Lucas: Some believe that palatability is relatively unimportant in practice except when something is extremely unpalatable.

Blaser: The most important use of palatability information is to learn what species mixtures will maintain proper balance under grazing. We cannot maintain a balance if palatable and unpalatable species are used together in a sward.

McCullough: We must remember to evaluate pasture mixtures in terms of the product one wishes to produce, i.e. milk, beef, etc.

Group II - Forage Crop Breeding, First Session

E. C. Holt, Tex., Chairman

R. P. Bates, Okla., Section Secretary

1:30 P.M. Panel Discussion on Advances, New Ideas, Special Problems and Plans.

Alfalfa - C. H. Hanson, N. Car., Discussion Leader

Dr. Hanson mentioned the need for uniform testing of alfalfa varieties in order to obtain information on varietal adaptation. He stated that he had asked breeders from various states to give a discussion of their work. A brief summary of each discussion is as follows:

E. C. Bashaw, Texas.

Primary emphasis is being placed on the selection of types having some ability to withstand dry weather and make rapid recovery when moisture becomes available. A further objective is the development of non-hardy, early producing types for the southern areas of the state. At the present time these factors are considered to be of more immediate concern than disease resistance or additional forage production.

Several hundred selections, plant introductions and varieties have been observed in a spaced-planted nursery since 1950. Twenty strains have been selected for further study and are presently being increased vegetatively. Simultaneously open-pollinated progeny of the lines are being evaluated. Thus far, the most promising material is of African origin. A selection from P.I. 179946 appears promising for our southern area.

Polycross tests will be conducted and the development of synthetics is anticipated from the other lines.

R. D. Staten, Arkansas

Present activities in alfalfa breeding are directed toward development of higher forage producing strains with greater longevity of stands and more resistance to common diseases, screening available materials for lines that are resistant to Fusarium wilt and Bacterial wilt, and evaluation of selected clones from their polycross progenies.

The breeding work with alfalfa in Arkansas is young, so to speak, and no detailed report on selections can be made at this time. At present individual plants are being screened for disease resistance. In addition, a greater degree of water tolerance is sought; however, ^{we have} no proof that such a characteristic exists.

In 1952 about 2,000 spaced plants selected from the varieties Oklahoma Common and Kansas Common, were set out at two locations, Osceola and Fayetteville. Many of these clones have been eliminated because of susceptibility to disease, chiefly bacterial wilt, Fusarium wilt, and downy mildew. About sixty clonal lines of the most promising selection have been planted in a polycross block for evaluation as to disease resistance and yield of seed and forage. One forage cutting was made last year and

preliminary disease notes were taken. These results and notes indicate that chances are good that something of value will come out of this material. In 1954 about 300 new clones were added to the clonal nursery selected from old fields of Oklahoma Common, Buffalo, Argentine, Indian, and Chilean alfalfa. This year is the first for observation of their performance.

Future plans include evaluation of progeny in the alfalfa polycross block and expansion of clonal collections for use in the breeding program. An establishment test is to be initiated this fall on wilt infested soil. Several soil fumigants will be applied in an attempt to discover the causal agent of poor stands (nematodes, Rhizoctonia blight, etc.). This will be a cooperative project with the forage pathologist. The forage crop pathologist, who is now making a detailed survey of troublesome forage diseases in Arkansas, will establish an alfalfa disease nursery where selected plant materials can be screened for disease resistance.

T. J. Smith, Virginia

Primary objectives^r at the present time are to improve the Williamsburg variety. This variety holds a satisfactory stand longer than other varieties, especially in eastern Virginia, apparently due to its excellent competition with weeds and its resistance to the root disease complex. Work is being conducted on root disease problems and the factors involved. Little progress has been made on this to date.

Resistance is needed for blackstem, down mildew, and leaf spots (Pseudopeziza and Stemphylium leaf spots). Additional resistance to leaf yellowing is also needed. This condition can be caused by physiological factors, diseases and insects. Increased seedling vigor is being considered and some attempt is being made to determine the feasibility of an earlier maturing variety.

A number of clones show considerable resistance to blackstem, downy mildew, and Pseudopeziza leaf spots. No appreciable resistance to Stemphylium leaf spots has been noted. No evaluations are available to date on earliness or seedling vigor, although there is considerable variation in these factors.

There is a serious problem with stem nematodes on certain farms in Virginia. Considerable work has been done on this and now materials have been obtained which have some resistance to the nematode. Much more needs to be done, however, before any material could be considered for release. The plant pathologists are experimenting with nematicides for soil treatment. Two insecticides, aldrin and parathion, have given good control experimentally.

One problem has been virus infections of clonal material. Most clones become infected sooner or later. No identifications of the virus or determinations of the amount of resistance available has been attempted. Some clones, however, appear much more susceptible than others while a few have remained entirely free of infection. The virus is more evident on clones grown or propagated in the greenhouse.

C. H. Hanson, North Carolina

Current activities in alfalfa breeding include field and greenhouse testing of varieties and experimental strains. For varietal improvement a reciprocal recurrent selection scheme and mass selection are being used. Most of the plant material traces back to 1600 plants selected in 1950 from old strain tests and old fields. Work is being initiated to transfer the creeping habit of Canadian lines to southern varieties. The F₁ hybrids are currently being grown for production of F₂ seed. A study is being made of the inheritance of rust resistance and several other traits. A collection of plants showing resistance to specific diseases is being maintained and enlarged.

Materials available for testing include five experimental synthetics which have been increased sufficiently by ARS field men in the West for evaluation trials.

Other Comments

C. H. Hanson, North Carolina

Possibility of regional organization of alfalfa variety testing, including possible breakdown to obtain greater uniformity of entries within sub-regional areas. A core of varieties should probably be used with the sub-regions (eastern, Delta, western, etc.) adding other varieties as desired. Uniformity in manner of testing, cultural practices, etc. was discussed. With a core of varieties and uniformity, data could be summarized and reported for the southeastern region.

H. O. Graumann, Beltsville, Md.

First effort to organize work was in 1934. Purpose of first alfalfa conference was to discuss problems such as disease resistance, leaf hoppers, aphids, winterhardiness, slow recovery, etc. Early in the organization an effort was made to set up uniform testing. The testing program grew until it was hard to handle. As a result it was divided into Eastern, Central, and Western Regions. The National Alfalfa Conference meets in even years and the regional groups meet in odd years. In 1950 it was found that uniform tests were not uniform. There were not enough common checks, and tests were established in different years. In 1952 at Raleigh, North Carolina, the group decided it was time to do something about uniform testing.

At the April, 1954 meeting, uniform testing of alfalfa in the Southeastern United States was considered. Seed for establishment in 1954 were requested by 5 of the 13 states. A few other states indicated request for seed for establishment in 1955. Dr. Graumann indicated that he would be happy to cooperate with uniform tests for the Southeast by assisting in getting seed together for the tests and assembling data. The tests should probably include breeding materials that show promise.

J. L. Allison, North Carolina

Presented samples of alfalfa infested with stem nematode and stated that this nematode has probably been overlooked for some time in Tenn., Va., and N. Car. In Europe this nematode has occurred more often on clovers and has a wide host range. Grows on some non-leguminous plants. Symptoms are conspicuous only on first flush of alfalfa. Was identified at three locations on different sites in N. Car. Appear to be different strains of this nematode. Seedling reaction to stem nematode can be checked very rapidly. In so-called resistant material under favorable conditions, symptoms sometimes appear. Stem nematode does not attract only young seedlings or young growth after cutting, but is most evident at that stage. Whole fields do not usually get killed, but only in spots.

H. O. Graumann, Beltsville, Md.

There were many inquiries concerning the place creeping alfalfas have in agricultural economy. Question was asked concerning what creeping alfalfas have done for people that have grown them. Several workers replied as follows:

M. C. Bashaw, Tex.: They do not spread.

R. D. Staten, Ark.: They do not spread, are susceptible to diseases.

N. L. Taylor, Ky.: Nomad does not spread, Rhizoma shows some spreading. Has not been grazed enough to determine if it can stand rough grazing.

J. M. Elrod, Ga.: Rhizoma does not really spread but does have a wide crown. Nomad appears to spread. The soil is Cecil clay loam.

H. O. Graumann, Md.: These types are not expected to yield as much as hay types. A new "creeping" variety from Canada called Rambler. Rhizomes from creeping alfalfa which were chopped produced good stands in the greenhouse. Chopped rhizomes will be tried in the field.

J. M. Elrod, Ga.: Out of 25 alfalfa varieties tested in 1952, Selvera and Rhizoma look good. Seed have been collected from old stands in fields and spaced plants are being observed. An effort is being made to get resistance to leaf spot. Alfalfa acreage is increasing in Ga. and there appears to be a place in this state for alfalfa.

G. W. Burton, Ga.: Good stands of alfalfa are obtained in Georgia but disappear in about one year. In some cases where soil was treated better stands and growth resulted. Are trying to determine what factors are involved in losing alfalfa stands.

Questions and Answers:

Q. C. H. Hanson, N. C.: Are stem nematodes associated with alfalfa hay?

A. T. J. Smith, Va.: Some farmers that got alfalfa hay from the West have stem nematodes.

Q. H. O. Graumann, Md.: Did the hay come from a specific area?

A. T. J. Smith, Va.: I don't know.

Q. P. R. Henson, Md.: Does the stem nematode attack other legumes in this area?

Q. W. R. Paden, S. C.: Is there any information on French alfalfa? It has shown up well in South Carolina.

- A. N. L. Taylor, Ky.: Stands of French alfalfa have been reduced by low temperatures.
- A. T. J. Smith, Va.: Have had French alfalfas in several tests. It does well sometimes but does very poor in some tests. Has persisted well but appears to be a poor competitor with weeds.
- A. C. H. Hanson, N. C.: French alfalfa appears to be promising in North Carolina and stays in stands well.

Alfalfa Variety Testing in the Southwest

Dr. C. H. Hanson distributed mimeographed information concerning recommended varieties, number of tests being conducted, and people conducting tests in various states. The information is as follows:

State	Varieties Recommended	Var. tests contemplated fall 1955-spring 1956
Ky.	Atlantic, Buffalo, Ranger	5 or 6
Va.	Kansan Common, Williamsburg, Atlantic, Buffalo, Okla. Common, Narragansett for high elevations only	4 or 5
N. Car.	Atlantic, Williamsburg, Okla. Common, Buffalo for bacterial wilt infested soils	3
Tenn.	Narragansett, Atlantic, Buffalo, Williamsburg	?
Ark.	Buffalo (gen. recom.). Kansas Common, Okla. Common and Atlantic if wilt is not a problem	2 or 3
Okla.	Okla. Common, Buffalo and Atlantic for seed production	?
Tex.	North area - Buffalo, Atlantic, Tanger and Common types (especially Barstow Common). South area - African, Indian, Hairy Peruvian, Ariz. Chilean General recommendation - Southwest Common	?
La.	Buffalo, Okla. Common, Kansas Common, Southwestern, Chilean Imported, Chilean Arizona grown.	3
Miss.	Kansas Common, Buffalo, Okla. Common	No
Ala.	Kansas Common, Okla. Common, Buffalo, Williamsburg, Atlantic	2
S. Car.	Okla. Common, Kansas Common, Atlantic, Arizona Common (Coastal area only)	4
Ga.	Kansas Common, Okla. Common	2 or more
Fla.	Hairy Peruvian	1 or 2

Alfalfa Variety Testing

Ky.	N. L. Taylor, Lexington	Tex.	E. C. Bashaw, College Station
Va.	T. J. Smith, Blacksburg	La.	C. L. Mondart, Jr., Baton Rouge
N. C.	C. H. Hanson, Raleigh	Miss.	H. W. Bennett, State College
Tenn.	L. N. Skold, Knoxville	"	H. W. Johnson, Stoneville
Ark.	R. D. Staten, Fayetteville	Ala.	W. R. Langford, Auburn
"	J. F. Jacks, Osceola	S. C.	W. R. Paden, Clemson
Okla.	W. W. Huffine, Stillwater	Ga.	G. W. Burton, Tifton
Fla.	E. S. Horner, Gainesville		

Dr. Bashaw stated that the discussion would include remarks on present status, new ideas and future approaches in Dallisgrass improvement. Discussions were given by various men working with Dallisgrass. A brief summary of these discussions are as follows:

E. C. Bashaw, Tex.

Dallisgrass is one of our most important perennial, warm season forage grasses in the South. It is well adapted to much of the region and is widely grown from East Texas to the Atlantic coast. In general, common Dallisgrass is an excellent forage producer but has a rather distinct limitation, specifically seed production and the related susceptibility to ergot disease. There are good seed producing strains available but these are not desirable forage types.

The prospects for a breeding program with this species is complicated by a number of factors, some of which are listed as follows: (1) apparent apomixis or, (2) some other barrier to hybridization, (3) extreme irregular chromosome behavior, and (4) selection is a problem because seed production is very sensitive to environment. When working with a plant having these characteristics the need for cooperation and free exchange of ideas among interested breeders is obvious. It is also apparent that ideas and experiences in working with Dallisgrass might apply equally well with other species.

The breeding work with Dallisgrass in Texas is relatively young. As an introduction, I would like to mention a few of our problems, outline our approach and mention a few of our ideas. Our first approach has been an attempt to determine the influence of environmental factors on seed set begun by Dr. Holt in 1950. In other words, the first attempt was to establish objectives for the breeding program. The environmental factors that we have studied include temperature, relative humidity, and nitrogen applications. The results to date indicate that seed set is best before June 15 where maximum daily temperatures are below 90° and minimum relative humidity is above 40 or 45 percent. Early spring application of nitrogen increases total seed production but may decrease percentage seed set slightly. Under the best conditions so far studied, seed set seldom averages more than 50% which definitely indicates that something other than environmental factors is influencing seed set.

The other phase of our work is a cytogenetic study of the species. We assembled all of the types of Dallisgrass which one could locate and have made a systematic study of the embryo sac development of each. These may be broadly classified into 5 vegetative types but actually fall into only two classifications on the basis of embryo sac formation and chromosome behavior. We have looked at enough of the pollen mother cells to be in full agreement with Dr. Forbes' findings which he will cover shortly.

I have a few slides showing briefly the embryology encountered with these types. In all types the development including meiosis is normal up to the 8 nucleate embryo sacs. The yellow-anthered type obtained from Dr. Burton is completely normal all the way and development to mature embryo may be followed step by step. In this strain the antipodals divide freely, forming a rather compact cluster in the center of the ovule. These persist until shortly after fertilization and then are gradually absorbed.

All of the other types behave about alike. Here again the antipodals divide profusely but instead of remaining in a cluster they spread apart, frequently in pairs, and fill the entire cavity in the ovule. This makes it practically impossible to tell exactly what happens from that point on. In all cases the nucellus seems normal and it would appear that the only obvious chance for apomixis rests with the antipodals. In general, it appears that sexual reproduction takes place but the occasional occurrence of these embryos makes one cautious. Likewise, the occurrence of these large paired antipodals suggests the possibility that they might sometimes fuse to form apomictic embryos.

About all we can say at this time is that here is a plant which behaves like an apomict, yet shows no positive evidence for this from the female side. With a good marker like another color many interesting studies are possible and I am sure that the approaching discussion will bring out some such possibilities.

G. W. Burton, Ga.

The naturally occurring Dallisgrasses that we have seen to date fall into 3 groups: (1) The common Dallisgrass that has been planted in Dallisgrass pastures, (2) The erect, yellow-anthered type--an introduction from Paraguay, and (3) The prostrate pauciciliatum type, also an introduction from Paraguay.

The erect yellow-anthered type sets seed well and is quite resistant to ergot but does not show much promise as a forage grass. The prostrate pauciciliatum sets seed very poorly, is most susceptible to ergot, is most resistant to foliar diseases Helminthosporium and Colletotrichum, and shows considerable promise for pasture purposes.

All three types appear to be (on the basis of progeny tests) very highly apomictic. Although slight variants have been observed in groups (1) and (3), they have given rise to progenies like the female parent. Most of the variants observed to date would not have permitted appreciable advance had they been selected and increased.

Attempts to intercross these types have to date given rise to only two hybrid plants between types (1) and (2). One of these gave rise to an apomictic progeny, while the other gave a segregating progeny. None of the segregates showed economic promise, however.

An effort has been made to improve Dallisgrass by interspecific hybridization. A number of (P. urvillei X P. malacophyllum) X P. dilitatum hybrids have been made. All have had excellent vigor and forage qualities. While most of these were susceptible to ergot, two were immune, suggesting that Dallisgrass carries some genes for ergot resistance and that advance in ergot resistance could be made if the apomixis in Dallisgrass could be broken. One Dallisgrass X P. malacophyllum hybrid was produced but it was inferior in forage quality. Other Paspalum species have been hybridized in an effort to produce a grass that might substitute for P. dilitatum. To date none of these hybrids have been outstanding. All of them have been slightly sterile. They usually set seed only when given a pollinator and the seeds produced usually give progenies that fail to segregate or the segregates are very inferior types.

A new project has just been initiated in which X-ray and thermoneutron irradiation will be used in an effort to improve this species.

Ian Forbes, Georgia

Common Dallisgrass (Paspalum dilitatum), the prostrate variety pauciciliatum, and the erect yellow-anthered type each have $2n = 40$ chromosomes. Most other Paspalum species have been reported to have chromosome numbers in multiples of 10, ranging from $2n = 20$ to $2n = 160$.

The erect, yellow-anthered type of Dallisgrass has 20 bivalent chromosomes at diakinesis and metaphase I. Meiosis is regular, the pollen appears to be good and seed set is good.

Common Dallisgrass has a variable number of bivalents and univalents at diakinesis. B. W. Smith reported that this grass typically forms 10 bivalents and 20 univalents. The bivalents disjoin normally at metaphase I, while the first 10 univalents undergo mitotic division. The second 10 univalents divide later and 8 to 10 lag at the equator and disintegrate during telophase and interkinesis. The second division and tetrad formation are normal. Very few micronuclei occur. R. P. Celarier, studying a wide range of material, reported similar chromosome behavior during meiosis except that variations in the number of univalents at metaphase ranged from 8 to 40. Most plants had a high percentage of stainable pollen despite the fact that some chromosomes were always observed to be lost during meiosis. Seed set in this grass is poor.

The prostrate variety pauciciliatum has been reported by B. W. Smith to resemble common Dallisgrass at metaphase I, except that approximately 20 univalents lag while the bivalents disjoin and proceed to the poles. In the material under study by Forbes, most of the chromosomes are unpaired at metaphase I. The few bivalents disjoin and pass to the poles at anaphase I. The univalents assemble in one or more random groups, do not move to the poles, and form one or more nuclei of varying sizes. Meiosis II has never been observed to occur. Although cytokinesis usually took place to form diads, triads, and tetrads, some monads were observed. Diads were the most common. The pollen size is highly variable but little abortion takes place. Seed set is poor.

The maintenance of a chromosome number of $2n = 40$, despite the consistent production of aneuploid gametes, strongly suggests that some form of a sexual reproduction is responsible for seed development in common and prostrate Dallisgrass. The large number of unpaired chromosomes at metaphase I in these two grasses suggests that they arose through hybridization. The regularity of meiosis in the erect yellow-anthered type make it a suspect as one of the parents.

Work in progress at Tifton includes:

1. Attempts to recover sexuality and/or higher seed set in prostrate Dallisgrass and sterile Paspalum interspecific hybrids by doubling the chromosome number with colchicine treatments.

2. Studies of chromosome numbers and meiosis in other Paspalum species which might be used to produce a substitute Dallisgrass.

3. Studies of chromosome numbers and meiosis in interspecific Paspalum hybrids.

H. W. Bennett, Mississippi

Have made some crosses at State College and got some segregation, including some plants that showed resistance to ergot, but they were sterile. Ergot is important in cattle grazing. Seed production is most important. In spacing and fertilization studies plants 36 inches in rows and side-dressed with nitrogen produced as much as 300 pounds of seed per acre.

Questions and Answers

Q. C. H. Hanson, N. C.: Were antipodals showing regular division?

A. Ian Forbes, Ga.: Yes.

Q. G. W. Burton, Ga.: Is there any evidence in nuclear cells?

A. Ian Forbes, Ga.: No.

Q. E. C. Holt, Tex.: If there is apomixis, why isn't there better seed set?

A. G. W. Burton, Ga.: Could be some degree of apomixis.

Q. G. W. Burton, Ga.: Has any evidence of cleistogamy been observed?

A. E. C. Bashaw, Tex.: No.

Other Comments:

H. W. Bennett, Miss. Germination is better after a year or two. Heat treatment is a possibility to improve germination. Ergot does not affect seed set and in some cases might prevent shattering.

G. W. Burton, Ga. Seed set at various dates ranged from 0.5 to 48.6 percent.

Rye grass

H. W. Bennett, Mississippi.

A selfing program is being conducted with rye grass. Artificial inoculations with rust are being made. Both greenhouse and field trials are being conducted, with close correlation existing between the two. Six rye grass lines have been selected which show about 75 percent resistance to rust. Lines were obtained that are very different in growth habit, some being erect and some prostrate. Growth period of various lines is very different, with some lines making very early growth in the fall.

E. C. Holt, Texas

In Texas essentially the same thing is being done as is being done in Mississippi. At the present time we are in the third generation of selfing. Behavior to rust is not consistent. Rye grass plants will be inoculated with rust in the greenhouse next year. All rust resistant material has been traced to Uruguay introductions. A possible loss in vigor and resistance to disease might result from selfing. In addition to rust resistance, a rye grass is desired that will grow off early in the fall.

H. D. Wells, Georgia

In the spring of 1953, 8 resistant or apparently immune rye grass plants were selected from 2200 plants of the Westervold variety. Four of these 8 plants set seed. Progeny from these 4 plants gave about 75 percent resistance. By this time probably 96 percent resistance has been reached. Should get immunity instead of percent resistance. Need to find out if all people are working with the same material. Resistant selections were recovered that are very similar to the original variety.

Questions and Answers

Q. G. W. Burton, Ga. What was the source of material being used in Miss.?

A. H. W. Bennett, Miss. Plants were selected from strain tests.

Sudan

G. W. Burton, Georgia

Where several genes are involved in inheritance, a large population is needed to recover homozygous recessive plants. Tift sudan was selected from a large population in a short time. The method used in producing Tifton 337 involved crossing several varieties and strains of sudan. Selection and crossing was continued until the final selection was made. This indicates what can be done by selection and recombination. Disease resistance was added to 337 and the prussic acid content lowered from 3.0 to 1.2 percent. Good yields have been produced by 337.

Millet

G. W. Burton, Georgia

In real dry years cattail millet starts off much better than sudan. In the future more attention will be given to millet. Objectives include obtaining a better type for the farmer and cow; probably by increasing leaf percentage and shortening internodes, such as with Starr millet. Starr millet gives grazing for a longer period but does not produce forage as quickly. Hybrids can be produced by pollinating the stigmas a day or two before the anthers dehisce. Some selfs are obtained by this method but probably not enough to reduce yields. Even with a 50 - 50 percent mixture of hybrid and selfed seed, about 96 percent yields are obtained.

Questions and Answers

- Q. T. J. Smith, Va.: Starr millet does not make good growth at Blacksburg. Could this be day length?
- A. G. W. Burton, Ga.: It could be. Starr millet is not doing well in Pennsylvania and Oklahoma.
- Q. T. J. Smith, Va.: What method is used for leafiness determinations?
- A. G. W. Burton, Ga.: Mechanical separation.
- Q. W. A. Cope, N. C.: How is the protein content of Starr millet?
- A. G. W. Burton, Ga.: It will vary with fertilizer treatment.
- Q. H. W. Bennett, Miss.: How long will it be until millet will be ready to take over sudan in Georgia?
- A. G. W. Burton, Ga.: It is ready now.

Wednesday, June 15

8:00 A.M. Group III - Environmental Factors - D. E. McCloud, Florida
Chairman.

The Light Factor, H. A. Borthwick, Beltsville, Md.

Control of flowering has been attributed either to long photoperiods or to short photoperiods--the so-called long- or short-day plants. Actually the length of the dark period is the governing factor. Short-day plants, for example, require a long dark period. The leaf is the primary organ for receiving light response and translocating it to other plant parts. Temperatures within the range of 55-90°F. not critical in modifying the light response.

Radiation in the infra-red range of spectrum found most effective around 6000-6500 Angstrom units. When fluorescent bulbs are used, a special type is necessary.

Photoperiods may produce as striking effects as fertilizer. Growth can be stopped completely. Germination of seeds also affected by light. Color of tomatoes reversible with photoperiod and the internodes of beans affected. Color of animals also affected as with the Arctic hare, ptarmagin and other animals.

Considerable interest was shown. Many questions were asked.

H. W. Bennett, State College, Mississippi, gave a paper on photoperiodism and its effect on forage plants.

Dallisgrass: Flowering took place on a 14-hour day(light period) at 70°F. Poor plant growth at same light period at a lower temperature (about 50° F.)

Bahiagrass: Flowering occurred under similar conditions, 12-14-hour day.

Johnsongrass: Flowered when given 8 or more hours of light. When prechilled, flowering was greater. Flowering was greater the higher the temperature, but prechilling was necessary for flowering.

Grimson Clover: Flowering dependent upon low temperature.

In the discussion that followed, Dr. Borthwick said temperature and light were both factors governing germination in seeds.

The Nutrient Factor

R. E. Blaser, Virginia, presented data and discussed this phase as it affects forage production.

Establishment of seedlings, as related to the nutrient and environment-- seeding rates for orchardgrass-alfalfa mixture depends upon season of planting. Three pounds of orchardgrass too much in spring but one bushel not excessive in fall.

The explanation seems to be that with the low soil temperature in the spring, nitrification is retarded. High rates of nitrogen fertilization then are favorable for grass with a consequent competitive retarding of alfalfa.

Response of legumes to fertilization -- alfalfa gave greater response to phosphorus, potassium and especially lime than did lespedeza. Alfalfa responded to boron where several other legumes did not.

Competition for light and moisture affected yields from white clover and bluegrass mixtures. The 1/2" cut favors clover, 2" cut shades out clover. The grass appeared to be greater competitor for nitrogen at high nitrogen levels than did the clover.

Legume-grass interaction studies -- alfalfa-orchardgrass top-dressed with nitrogen showed no increase in yield with the increased nitrogen. Increasing the potassium fertilization did increase yields by making the alfalfa more competitive to the grass. Potassium applications should be split; one-half in late winter and one-half after second cut of hay.

At Middleburg, Virginia, clover was observed to be equivalent to 150-200 pounds of N per acre.

DISCUSSION:

Burton - Is the potassium and phosphorus bill as high for grass as for clover?

Answer - Potassium a little higher; phosphorus about the same over a long period of time. Can start with lower amounts in the soil.

Hodges - Nitrogen in emergency only; clover mixtures to be preferred (in sections of Florida).

Blaser - Raised quite a discussion about non-uniformity of cattle used in grazing trials. Should avoid reporting high gains in many experiments.

High nitrogen was thought to increase winter killing of Pangola-grass in Florida. A discussion on winter killing developed.

The Moisture Factor

Panel discussion by D. S. Chamblee, M. J. Gilbert and D. E. McCloud.
D. S. Chamblee, N. C., was moderator.

Chamblee: Introduced the subject of moisture and evapotranspiration.

Gilbert: The evapotranspiration concept is useful in determining when to irrigate. Evapotranspiration is the return of moisture from a vegetative surface when moisture in root zone does not limit growth. It is useful in an analysis of drouth data from evapotranspiration studies at Waynesville, North Carolina, in close agreement with values computed according to Penman and Thornthwaite.

McCloud: Two major and two minor factors influence the rate of evapotranspiration. The major factors are quantity of energy available and amount of moisture in the root zone. The minor factors are character of the surface along with wind and vapor pressure. Thus the maximum possible rate of evapotranspiration will depend largely on the amount of solar energy available.

Holt presented some work from an irrigation experiment in Texas showing that adequate fertility increased the efficiency of water utilization.

DISCUSSION:

High interest in use of formulae to determine amount of water needed for optimum growth.

Meetings closed by motion by O. E. Sells to hold the environment factor meetings each year. Approved by vote of group.

Wednesday, June 15

8:00 A.M. Group IV - Seed Production, E. D. Donnelly, Ala., Chairman

Improved Procedures for Forage Seed Harvesting and Processing and Improved Harvesting and Processing Machinery, H. D. Bunch, Miss., Discussion Leader.

R. F. Richards, Tenn., reported on "Preharvest Desiccation of Crimson Clover and Orchardgrass". Summary:

To determine the influence of chemically induced drying on uniformity of maturity and on yield, quality and viability of seed and to evaluate and to develop spray and harvest equipment, replicated, randomized plots of crimson clover were sprayed with various chemical desiccants (contact herbicides) in 1953 and 1954.

In crimson clover tests, there were no significant differences in yield, moisture content, germination or hard seed in either of the two years tested. Orchardgrass results showed no significant differences in yield or moisture content for either year. Differences in germination tests were not significant in 1953. However, in 1954, seed from the Endothal and the PCP treated plots had a significantly higher and a significantly lower germination, respectively, than the seed from the check plots.

Research is being continued in 1955 on crimson clover with oil-soluble Dinitro and with Endothal sprays, which appear to be the most effective herbicides of those already tested.

H. D. Bunch, Miss., reported on "The chemical desiccation of small-seeded legume crops for seed harvesting". Summary:

Desiccation of white and crimson clover as aid to seed harvest - Tests were conducted in 1952 and 1953 to determine the effect of several desiccants (sometimes referred to as defoliants) applied at 3 levels of concentration on crimson and white clovers for seed harvesting. Principal criteria used in evaluating treatments (desiccants and desiccants x rates) were: (1) moisture content of the top growth, and (2) percent germination and hard seed content. The effects of treatments on harvested seed yield and on the survival and regrowth of white clover were studied in 1953.

The moisture content of the top growth of crimson and white clover was sufficiently reduced to facilitate direct combining by the following treatments:

1952

Crimson clover:

Endothal:	1 to 5 quarts per acre
Oil soluble Dinitro:	1 to 3 pints per acre
Water " "	5 pints per acre
Sodium monochloroacetate:	10 lbs. per acre

White clover:

Endothal:	1 to 5 quarts per acre
Oil soluble Dinitro:	2 to 4 pints per acre

1953

Crimson clover:

Endothal:	1 to 5 quarts per acre
Oil soluble Dinitro:	2 to 6 pints per acre
Golden Harvest:	2 to 4 quarts per acre

White clover:

Endothal:	3 to 5 quarts per acre
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The following compounds, at the rates used in this experiment, were found to be unsatisfactory as desiccants of crimson or white clover:

Calcium cyanamid:	60 lbs. per acre
Monosodium cyanamid:	30 " " "
Aero cyanamid soluble:	30 " " "
Oktone:	5 quarts per acre

Desiccation of the top growth of the two legumes had no influence on the viability of the seed immediately after harvest or after the seed had been stored for 10 months. The more effective desiccants significantly reduced the percentage of hard seed in crimson clover and (with the exception of oil-soluble Dinitro) in white clover. Desiccation had no influence on the actual seed yield of white clover. The survival and re-growth of white clover plants was not affected by the treatments.

"Cleaning and Separating Grass Seed" was reported on by James Henderson, A. T. Ferrall and Company, Saginaw, Michigan. Summary:

The machines usually used for cleaning and separating grass seed are a scalper, the screen machine, the length separator, the debearder or hammermill and the huller. The scalper separates with screens the bulk of the trash, green weed seed and freshly killed insects harvested with the grass seed. The screen machine removes trash, weed seed, other crop seed and immature grass seed by passing the seed through and over a series of perforated metal or wire mesh screens.

Disc separators and cylinder separators separate seed according to comparative lengths. Debearders and hammermills are used for breaking apart grass-seed doubles, hulling some varieties and for removing irregular appendages that would prevent thorough cleaning.

Some varieties of grass seed are hulled with a legume huller and scarifier so that those seed can be better cleaned and will have a quicker, higher germination.

The system generally used for selecting screens for cleaning any type of seed is to select a round top screen and an oblong or rectangular top screen through which the seed will drop and to select an oblong or rectangular bottom screen and either a round, square or triangular bottom screen which will hold up the good seed and drop smaller seeds.

This system of selecting screens is applicable to the very smallest and very largest grass seed and all seed in between. There are many exceptions to this system. Some grass seed are harvested containing such a high percentage of weed seed that it is necessary to pre-scalp and pre-clean them with an oblong slotted screen to remove the bulk of the weed seed before they can be passed through a round-hole top screen that will make a worthwhile separation. Very tiny grass seed are generally cleaned by using woven wire mesh screens since the openings required are so small that they cannot be reproduced in perforated metal. Medium-sized and larger seed generally are cleaned with the perforated metal top screens and wire mesh bottom screens or occasionally a perforated metal bottom screen with triangular openings.

The basic cleaning is done with the screen machine and length separators. The special-purpose machines are used as required.

9:45 A.M. The Influence of Climatic Factors and Cultural Practices on Seed Production of Forage Species - E. C. Holt, Texas,
Discussion Leader

E. C. Holt reported on "The Relationship of Temperature and Humidity to Seed Set of Dallisgrass". Summary:

A study of the relationship of temperature and relative humidity to seed set of Dallisgrass was started in 1953. Individual seed heads were tagged on the first day of blooming and harvested as they matured. A hygrothermograph was used to record temperature and humidity. In 1953 maximum daily temperatures showed a significant negative relationship to seed set and minimum daily relative humidity showed a significant positive relationship. The lower the maximum temperature and the higher the minimum humidity, the better the seed set within the range of conditions encountered during the period from June to September. Maximum temperatures ranged from 81° to 100°F. and humidities from 18 percent to 54 percent. Seed set varied from 6 percent to 48 percent.

In 1954, the plants virtually ceased seed production after mid-June. Thus the results in 1954 were not conclusive. The results obtained indicated a similar relationship to temperature as in 1953.

Dr. Holt also reported on "The Influence of Nitrogen Application on Seed Production and Quality of Dallisgrass". Summary:

Early spring applications of nitrogen have increased the June seed crop consistently and significantly. A second application of nitrogen (June) has reduced the second seed crop significantly. There has been some tendency for the spring nitrogen application to reduce percentage of caryopsis in the seed material. Since seed quality is best in the spring, before June 15, a spring application of nitrogen (up to 60 lbs. N in these studies) is profitable.

W. W. Woodhouse, N. Car., reported on "The Influence of Nitrogen Application on Seed Production of Orchardgrass and Tall Fescue". Summary:

1. Nitrogen application is very essential for seed production of these species on the soils studied.

2. As might be expected, both species reacted in a similar manner to these treatments.

3. May 1, August 1, October 1 and February 1 were the dates compared. The most consistent yields were obtained from the February treatment. Seed yields of these species under North Carolina conditions are highly variable from season to season with a corresponding variation in treatment effects.

In all experiments, lime and mineral fertilizers were applied uniformly and to a level which would give reasonable assurance that they would be unlimiting. Management was planned on the basis that excess growth would be utilized for forage when such utilization would not interfere with seed production - harvests being made of regrowth during the summer and fall.

Higher rates of N, up to 400 lbs. per year, were included, however, higher rates resulted in excessive lodging and no consistent increase in seed yields.

DISCUSSION AND CONCLUSIONS:

1. Orchardgrass and tall fescue responded to treatment in a similar manner.
2. Results were quite erratic from season to season.
3. Of the dates of application studied, February was the most consistent.
4. The August application was very inconsistent but good enough at times to appear to warrant further study.
5. The May application was usually little or no better than no nitrogen as far as seed production was concerned.
6. The October application was intermediate in effectiveness between August and May treatments.
7. The split application, August-October, was about equal to the October treatment.
8. The October-February split, in fewer trials, was about equal to the February treatment.
9. Splitting 4 ways, 25-25-25-25, was less effective, on the average.

"Influence of Daylength and Temperature on Growth, Flowering and Seed Production of Selected Forage Species", by W. E. Knight and H. W. Bennett, Miss., was presented by Dr. Bennett. Abstract:

Two selections of Dallisgrass from Louisiana were grown in the greenhouse in 1951-52 and 1952-53 to determine their response to photoperiod and temperature. Particular emphasis was placed on flowering and seed production. Two greenhouses were used in these experiments. The night temperature in one greenhouse was kept between 65 and 70° F. and between 45 and 55° F. in the second greenhouse. Day temperatures were similar in the two houses, varying from 70 to 80° F.

The general response of Dallisgrass to photoperiod and temperature was the same in 1951-52 as in 1952. Dallisgrass failed to produce seed heads when grown under an 8-hour and a normal day. Seed head production under a 12-hour day was erratic and flowering was incomplete. A high night temperature and a 14-hour photoperiod appear to provide the most desirable environment for greenhouse production of Dallisgrass. Low night temperatures inhibited seed head formation in Dallisgrass under long day. The relationship of seed shattering to stage of maturity is shown in table 1.

Table 1. Shattering of Dallisgrass Seed as Related to Stage of Maturity

Plant Characteristic Measured	Stage of maturity when harvested		
	Stem and glumes green	Stem and glumes brown but not dry	Stem and glumes dry
Total number of florets (per head)	450	328	475
Number of florets shattered	150	173	243
$\frac{1}{3}$ shattered florets containing caryopses	97	81	67
Number of shattered florets containing caryopses	146	140	163
Number of non-shattered florets	300	155	232
$\frac{1}{3}$ non-shattered florets containing caryopses	14	5	5
Number of non-shattered florets containing caryopses	42	8	12
$\frac{1}{3}$ total florets containing caryopses that had shattered when harvested	78	95	93
$\frac{1}{3}$ caryopses in total florets	42	45	37

The results of this experiment suggest that a modified method of harvest for Dallisgrass is needed. A harvester utilizing a shaker or shaker-suction should result in seed of superior quality to that combined directly or from the windrow.

Bahiagrass: Pensacola and Argentine Bahiagrass were grown in the greenhouse as described for Dallisgrass. Flowering in Bahiagrass was confined to the 14- and 16-hour daylengths. Differences were not significant between 14- and 16-hour daylengths for number of heads, number of tillers, and percentage florets containing caryopses. Heading was earlier under the 14-hour day. Continuous low night temperatures inhibited seed head formation but stimulated seed head formation and uniformity when plants were rotated from low night temperatures to high night temperatures. Differences between strains were significant for seed production.

Johnsongrass: Flowering occurred under 8-, 10-, 12-, 14- and 16-hour daylengths in that order. The 16-hour daylength delayed flowering and plant behavior was not uniform. The normal and the 12-hour daylengths were uniform and produced highest yields of seed. These results suggest allowing Johnsongrass to mature late in the growing season for maintenance of rootstocks since forage yields would be reduced by the short days at this time and seed yields should be higher if field response is the same as under greenhouse conditions.

Crimson clover: Three varieties of crimson clover (Dixie, Mississippi and Common) grown under 6 photoperiods and 6 temperatures were significantly different in number of seed per head and percentage of seed set. Varieties differed in measurements of growth, but significant interactions prevented overall comparison. Low night temperature during the formative stage of growth had a striking effect on floral response. Plants grown under high night temperature failed to flower under 8-, 10- and 14-hour daylengths, whereas clover grown with a low night temperature and normal day flowered well. Plants rotated from low night temperature to high night temperature also flowered. Vigor of plants grown at low night temperature was superior to that of plants grown with high night temperature.

11:30 A.M. The Effects of Various Seed Storage Conditions on the Germination and Longevity of Forage Seeds - H. J. Ward, Jr., Ala., Discussion Leader.

Dr. Ward presented "Results of Research on Storage of Forage Crop Seed at the Alabama Agricultural Experiment Station". Summary:

Problems associated with the storage of forage crop seed are not different from those with other seed. Results of research on the storage of corn, wheat, and soybeans have shown that germinability after storage was dependent on the seed moisture content, temperature of the storage environment and time in storage. Prevention of decline in seed viability as the result of various temperatures and times of storage was shown to be controlled by seed moisture content and its equilibrium relative humidity.

The first step in seed storage research is to obtain the hygroscopic equilibrium curve. This curve will show various seed moisture contents and their corresponding relative humidities. Germination of seed held at the various storage relative humidities at various intervals of storage will enable the investigator to show which seed moisture content will prevent a decline in viability. Hygroscopic equilibria curves for seed of crimson clover, sericea lespedeza, and fescue grass were used to illustrate this concept.

Data on germinability of seed of crimson clover, sericea lespedeza, and fescue grass stored for 6 months at 75, 65, and 54% relative humidities showed that seed must be stored at moisture contents in equilibrium with relative humidities of less than 75% to prevent decline in viability. Highest germination after 6 months of storage was for seed held in equilibrium with 54% relative humidity. Equilibrium moisture contents in with 54% relative humidity were 10.0, 8.1, and 11.2% respectively, for seed of crimson clover, sericea lespedeza and fescue grass.

Trends in germinability of crimson clover seed stored for 3 years at 65 and 54% relative humidities, were used to show the following:

1. Maintenance of viability for less than one year was possible at 65% humidity while maintenance of viability for more than one year was possible at 54% humidity.
2. A decline in viability at 54% humidity occurred in the 3rd. year.
3. Based on these data, storage of seed for more than 2 years without humidity and temperature control is not possible in the Southeastern United States.

Oat seed of 10.7 and 8.7% moisture contents were stored at 86°, 95°, 98°, and 104° F., and germinability was checked after 3, 6, and 9 months of storage. Oat seed of 10.7% moisture had much lower germinations than did oat seed of 8.7% moisture after storage at temperatures above 86° F. These data show the necessity of low seed moisture contents in order to prevent losses in viability of seed that are stored during the summer months. Such low moistures would be difficult to maintain in seed stored in the Southeastern United States.

Germinability of sericea lespedeza seed after 3 and 12 months of storage at 13.0, 11.0, 8.9 and 8.1% moisture contents showed that scarified seed stored as well as unhulled seed at 8.1% seed moisture content. At seed moisture contents above 8.1% unhulled seed had less decline in viability.

R. E. Burns, Ga., reported on "Lupine Seed Storage Investigations Conducted in Cooperation with the Georgia Agricultural Experiment Station and the Field Crops Research Branch, ARS, U. S. Dept. of Agriculture". Summary:

Factors affecting the longevity of lupine seed in storage were discussed. Each factor was taken up in the order in which it is met by the producer. These included seed maturity at time of harvest, combine injury, delay in processing, drying temperature, moisture content at which seed are placed in storage and differences in warehouse locations. Small scale laboratory studies illustrating the temperature versus moisture aspect of longevity were discussed. An attempt has been made to find an index of deterioration based indirectly on enzyme action or permeability without success. The limitations of fat acidity as such an indicator and the need of further research on this subject was pointed out.

In summary, the conditions suitable for storage of lupines for a period of 3 years or more are: Combine with least severity necessary to thresh the mature seed, dry immediately to 12 percent moisture (11% for bin storage) at a temperature of 125° F. or less and store in a dry warehouse where moisture of seed will be maintained at 12.5% or less.

9:00 A.M. Group I - An Integrated Approach to Pasture Evaluation,
E. N. Fergus, Ky., Chairman

1. An Analysis of the Problems and Techniques of Pasture Evaluation,
G. O. Mott, Indiana

I. The Problem of Pasture Evaluation

- a. Determination of Physical Outputs:

The agronomist is chiefly concerned with the quantity and quality of forage produced per unit area of land; quantity as measured in pounds per acre and quality in terms of leafiness, freedom from disease, and chemical composition. The animal husbandman has as his primary concern the output per animal measured in terms of meat, milk, wool, etc., produced per steer, cow or sheep. Output of product per acre is the concern of both groups of workers. In general, we may express the product per acre as follows:

Produce per A = f(output of the sward, output per animal)
EX: Beef per acre = steer days x avg. daily gain.

- b. Evaluation to the Economist:

To the economist the word "evaluation" implies the placing of a monetary value upon a commodity. It is not the immediate concern of the agronomist and the animal husbandman to evaluate forages on this basis but rather to more accurately determine the physical inputs and outputs in the production and utilization of forages.

II. Techniques for Measuring Physical Outputs.

- a. Animal product per acre is the ultimate unit of measure desired. (see chart). This information is obtained directly from the grazing trial. All other measurements including forage yields, botanical composition, chemical composition, digestibility, rate of intake, animal behavior studies, and physiological responses of both the plant and animal contribute to our information for better predicting the output of animal product per acre.
- b. Predicting output of product per acre from forage weight measurements.
 1. Relationship of forage weight measurements to carrying capacity.

Forage yields provide a good estimate of the carrying capacity of a pasture. Poor correlations between forage yields and animal days may be the result of: (a) inadequate or biased sampling of the forage, or (b) the failure of the investigator to estimate carrying capacity at the optimum level.

The problems include the development of clipping techniques which closely simulate grazing conditions (Example: Clipping is much more drastic than grazing in its effect on the behavior of the plant. In early spring when food reserves are at a low level, the growing point of the grasses may be removed by clipping, resulting in very slow recovery).

2. Forage weight measurements and nutritive value.

Forage production per acre is a very poor indicator of nutritive value. Only under conditions where an element essential for both the plant and animal is limiting, would a close relationship be expected.

3. Forage yields and rate of intake.

May or may not be closely correlated depending upon the grazing pressure. Only if the amount of forage available were below that required by the grazing animals would a close relationship exist. The accumulation of an excess of forage may or may not seriously influence palatability.

c. Chemical Composition.

1. Proximate analysis is of doubtful value for predicting animal performance. When accompanied by estimates of digestibility the data may give some clue to the nutritive value and thus to animal performance.
2. Lignin, protein, and essential minerals may be very helpful where their presence in large ratios or absence to the point of being deficient is the condition under study.

d. Digestibility

1. The digestion trial, indicator methods and the use of the artificial rumen for the determination of digestibility, give relatively low experimental errors. The problems involve the sampling of the forage and the manipulation of the sample prior to the trial.
2. Artificial rumen as a screening technique for breeding material. Small differences in digestibility of forages may be determined. The problem here is to determine how closely correlated are the results from the artificial rumen and the true digestibility.

e. Rate of Intake

1. Usually not closely related to nutritive value, but a function of the palatability, grazing pressure and the direct effects of the environment upon the animal. Differences between species and varieties within species are difficult to determine because small differences in stage of growth, leafiness, weather conditions, soil conditions and idiosyncrasies of the animals may greatly affect the rate of intake.

f. The Grazing Trial.

1. A grazing trial conducted at the optimum or near optimum carrying capacity gives results which represent a composite of all the factors discussed above.
2. The sources and magnitude of the experimental errors.
3. Sources of bias - estimation of carrying capacity and the consequences resulting from the failure to estimate carrying capacity at or near optimum.

g. Previous treatment of the animal.

Relation of winter gain of animals to yield of beef per acre	
Winter gain lbs/day	Pasture yield of beef lbs/acre
0.5	421
1.0	303
1.5	296
2.0	164

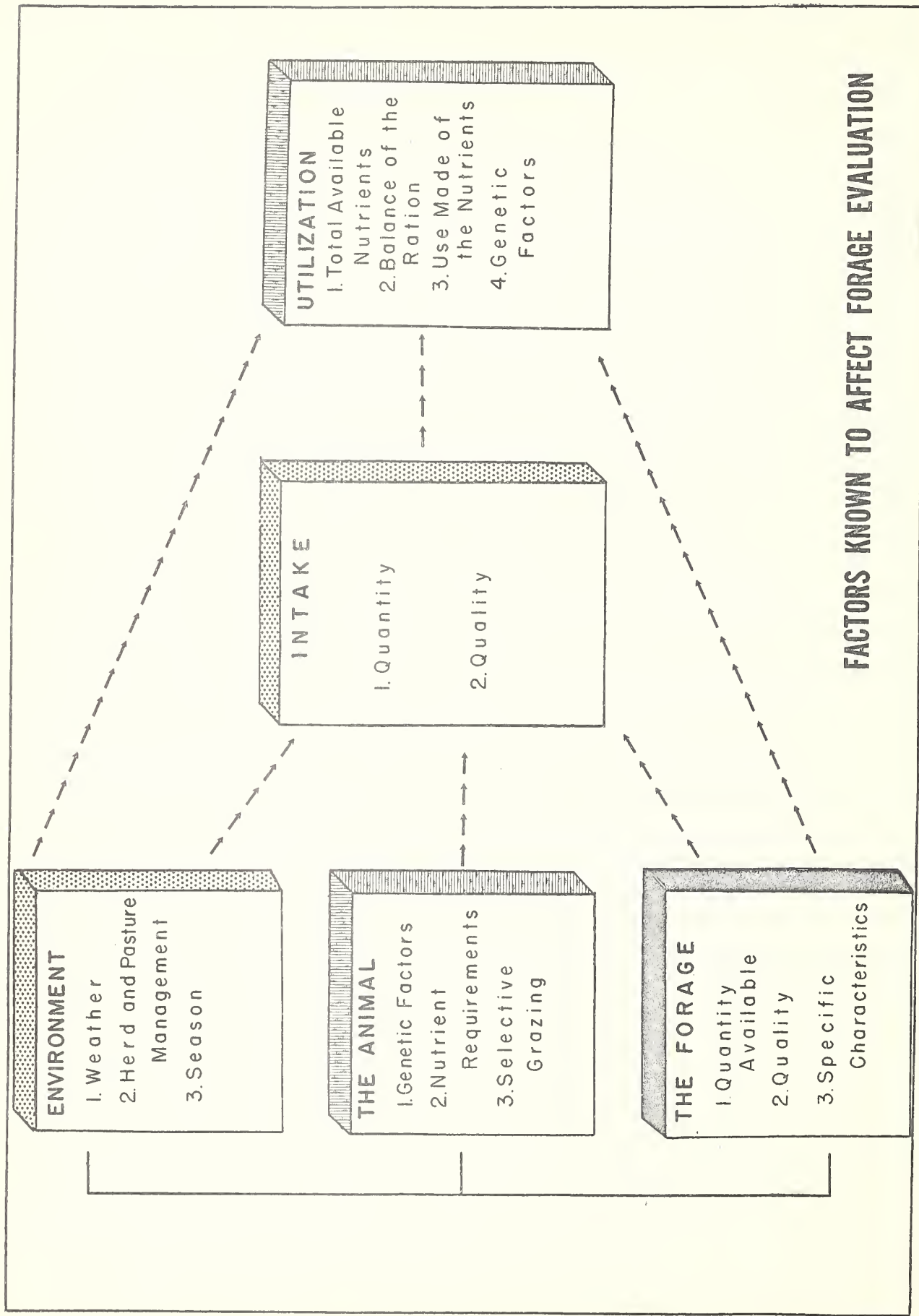
1. The application of the "tester" idea to grazing trials to multiply the amount of information.
2. Relationship to magnitude of the experimental error and possible sources of bias.

Panel Discussion - An Integrated View of Pasture Techniques
as seen by the:

Animal Husbandman - W. B. Anthony, Alabama
Range Specialist - E. H. McIlvain, Oklahoma
Biochemist - R. W. Engel, Virginia
Sward Husbandman - W. W. Woodhouse, Jr., N. Carolina
Dairyman - G. C. Graf, Virginia
Extension Specialist - S. H. Dobson, N. Carolina
Plant Breeder - G. W. Burton, Georgia

SUMMARY

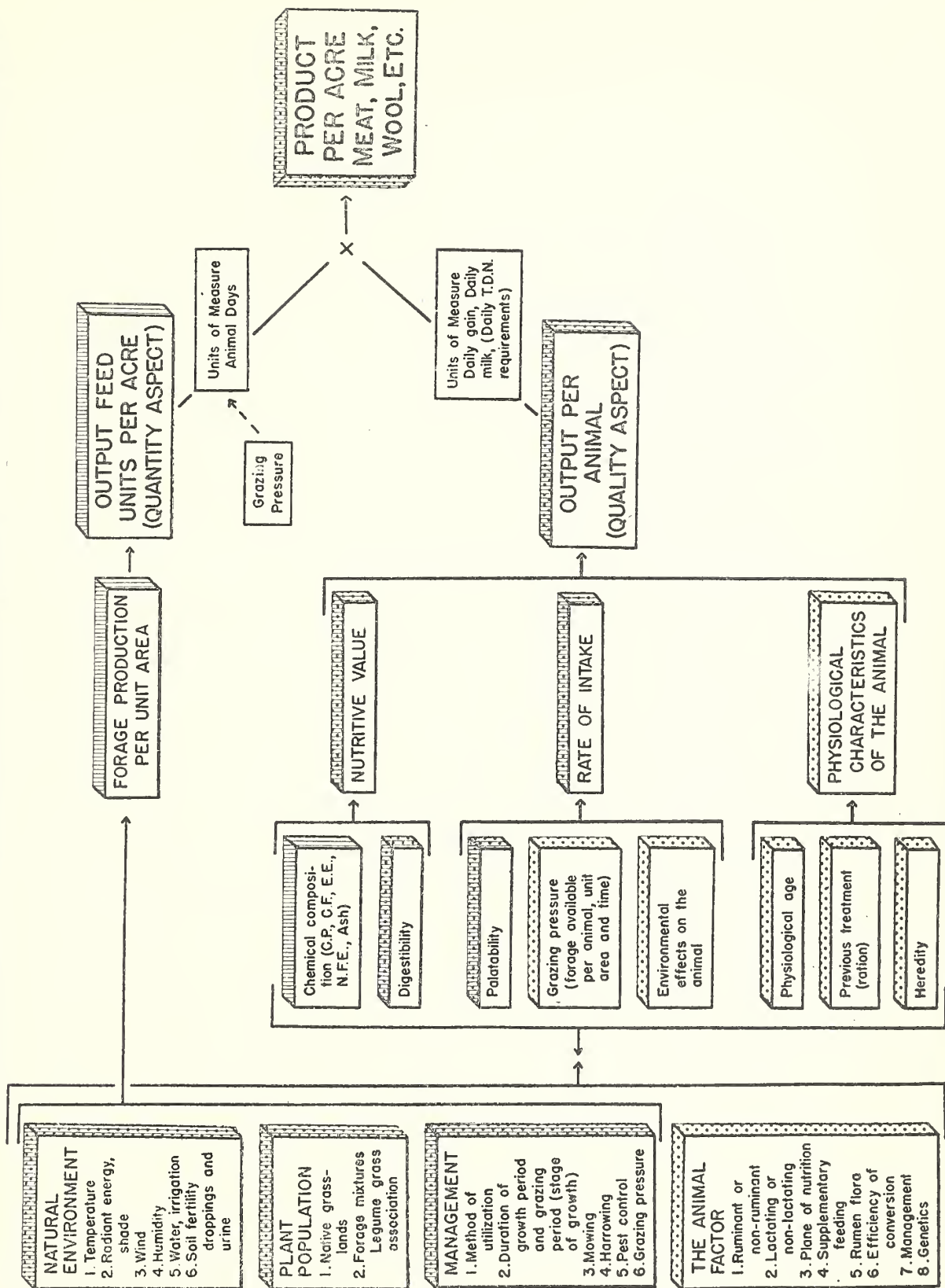
Fergus: A pasture, depending upon the plant population involved, the natural environment and the management, can yield forage of quality varying from high to low. This in turn, conditioned, of course, by the kind of animal grazing the pasture and by supplemental feeding, etc., can lead to animal performance varying from good to poor, the good performance coming from high quality forage and the poor performance from low quality forage. The principal question to be discussed today is whether we can, by measurements made on the forage, assess its quality in terms of animal performance, and if at present we can't make such an assessment, is there any hope of doing so in the future?



FACTORS KNOWN TO AFFECT FORAGE EVALUATION

RELATIONSHIPS OF NATURAL, BIOLOGICAL AND MANAGEMENT FACTORS THAT DETERMINE

THE AMOUNT AND QUALITY OF FORAGE, AND THE QUANTITY OF LIVESTOCK PRODUCTS PER ACRE



Engel: The problem seems to resolve into one of determining forage characteristics such as chemical composition and, considering factors such as portions of the plant involved and stage of growth, finding how animal response (forage consumption, digestibility, and animal production) are correlated with the measured characteristics. The problem needs more detailed and intensive study than has been given it heretofore and many problems of technique are involved. At Virginia we are concentrating on studies of the errors in the indicator methods of measuring consumption and digestibility, and on rumen physiology, using the artificial rumen. We need to learn more about the nutritional requirements of rumen flora. There is a possibility that toxic principles and hormone-like materials in forages play an important role in quality.

Burton: How can the forage breeder measure quality in terms meaningful to the animal? Certainly yield is not the sole criterion for selection.

Mott: Where should we look for indications of forage quality?

Burton: We have some objective measures of forage characteristics, but we don't know how well they predict quality for animals. For example, leafiness. We bred for leafiness with Pearl millet. Quality depends to some extent on management, too, thus complicating the assessment of quality.

Engel: How can we change the protein content of forage?

Burton: Probably most easily by management and fertilization.

Blaser: Shouldn't we do more digestion work early in the development of a variety?

Anthony: In working with Coastal Bermuda one is impressed with the seasonal fluctuations in composition and intake. Perhaps we should learn how to maintain quality and intake at a high level throughout the season, and then concentrate on methods of maintaining high yield.

Burton: If we turn to complete feeding (soiling, intensive strip grazing) can't we rely on clip plot data?

Graf: The team approach is essential. We need to standardize our digestion trial techniques and learn how to describe more completely the feed regime of the animal. Also, we need to give more attention to factors affecting the physiology of the animal, e.g., the general environment. Further, we should not lose sight of practical applications in developing evaluation methods.

McIlvain: In range work there can be a considerable difference between the nutrients produced by the pasture and the nutrients converted to animal production. Rodents and insects may consume large amounts of forage. Some Oklahoma ranges may produce 40 lbs. of beef per acre plus 30 lbs. of rodents. Parasites are also a problem, infestation increasing markedly with grazing intensity. How does parasitism influence the results?

Lucas: Have we given parasitism enough attention in the Southeast?

Blaser: We have to continue with pasture investigations even if parasites are present and uniform control measures should be used for all pastures in an experiment.

Engel: How does the error introduced by variation in animals affect the ultimate prediction of pasture value?

Lucas: Certainly the variation in animal performance is largely compared to the errors in the chemical and physical determinations of the characteristics of the forage. Additional errors are also present, however. There are errors in sampling the forage, especially in getting a sample of consumed forage under grazing. Another, one of the principal matters of this discussion, is the error that may be associated with assuming that a given chemical or physical determination on the forage measures quality from the standpoint of the animal. It is here that some of our greatest problems exist. Presumably, in the final testing of the value of a chemical or physical determination on the forage, errors due to animal variation can be reduced by using sufficient numbers of animals.

Lucas: One of the major factors affecting yield of product per animal is forage consumption. It seems critical to me, therefore, that we learn how forage consumption is related to forage characteristics.

McIlvain: It is essential to keep economic considerations in mind when evaluating pastures.

Woodhouse: We must point toward reliable estimates of inputs and outputs and factors affecting them. Our present problem is obtaining the tools for describing the units of input and output. One particularly touchy point is that no objective criterion is available for estimating optimum grazing pressure.

Dobson: The extension man is confronted with a number of problems. Some important ones are: (i) Often published data and the conclusions drawn from them do not appear to be compatible. (ii) In some important instances the recommendations for a specific practical situation vary markedly from state to state. (iii) How can we isolate the effect of pasture from other components of a feeding system. In general, we must aim for reliability, explainability and simplicity in producing and publishing results and in formulating recommendations.

Hogg & DeVane: What is the minimum level of protein that we should breed for?

McCullough: There is no set level. The minimum depends on the kind of animal involved for the purpose for which the forage is to be used. The desirable range seems to be 10 to 25% crude protein. To specify more closely would require considering several important factors.

Lush: Nutritional information is available to aid in answering the protein question.

Hardison: Generally, protein is not a limiting factor. Energy intake is usually the problem.

Sell: There are too many other important factors involved to worry too much about crude protein.

Barrentine: It seems clear that we must put top notch chemists to work isolating components in forage plants, so that we can learn to describe adequately the characteristics of a forage.

Group II - Plant Breeding, Second Session.

E. C. Holt, Tex., Chairman

R. D. Staten, Ark., Section Secretary

8:30 A.M.

11:45 " Panel Discussion on Advances, New Ideas, Special Problems and Future Plans- E. D. Donnelly, Ala., Discussion Leader

Sericea Breeding - Objectives, Principal Results and Future Plans, E. D. Donnelly, Ala. Summary:

The objectives of our sericea breeding work is a more palatable, more nutritious variety with increased forage and seed production. Principal results are as follows: Data from a study to determine the effects of outcrossing on forage and seed yields indicated the following: (a) Chasmogamous progeny averaged considerably more forage and seed production than cleistogamous progeny. (b) Plants differed considerably in general combining ability. (c) Families differed considerably in forage and seed yields and in persistence. (d) No difference between stands of the two types of progeny was indicated at the end of the fourth year in the field. (e) Forage and seed yields were not closely associated.

Chemical analyses, digestion trials with rabbits and In vitro studies with pepsin have been conducted to characterize the nutritive quality of several inbred sericea lines. This work is being conducted with Dr. G. E. Hawkins. Results are as follows: (a) In vitro digestion by pepsin of protein in leaves indicated a wide variation among lines. A significant negative correlation was found between tannin in the leaves and digestibility of protein by pepsin, indicating that tannin found in sericea affects the digestibility of protein. (b) Crude fiber content of stems from different lines varied considerably. (c) Results from studies with rabbits fed diets containing 50% sericea indicated the following: (1) Considerable variation in apparent digestibility ^{of protein} among lines. (2) Considerable variation among lines in dry matter intake and in digestibility of

the dry matter.

It is indicated that a more palatable, more nutritious variety with increased forage and seed production can be developed.

Future plans: (a) To develop synthetic varieties using inbred lines. (b) Lines will be evaluated for the above characteristic and others. Polycross performance^{tests} will be used in addition to chemical analyses and feeding trials in evaluating lines. (c) Attempt to combine characteristics such as low tannin, low crude fiber, high digestibility of protein and various desirable agronomic characteristics.

Lespedeza Improvement in Southern Oklahoma, R. P. Bates, Ardmore, Okla.

After sericea lespedeza is established in Southern Oklahoma, it usually does well and produces desirable forage. The first problem with this species on Southern Oklahoma soils is getting it established. Most of the soils dry out in the upper inch very rapidly following rains. If sericea is planted shallow, the soil often dries out below the seed, and if the seed germinate, the young seedling usually dies. If sericea is planted an inch or more deep, it usually cannot emerge, especially if a hard crust forms at the soil surface.

While germinating sericea seed from over 100 sources in the germinator, a very wide range was noted in the ability of seed to germinate rapidly and produce vigorous, fast-growing seedlings. Seed from some sources germinated in 3 or 4 days while some took 7 to 8 days. Some produced seedlings two inches long in 4 to 5 days while others produced seedlings that were only about one half inch long in 7 days. This difference in time required for germination and size of seedlings produced might make a great difference in emergence and establishment of stands when frequent rains do not follow seeding.

Notes were taken on behavior of seed from different sources while in the germinator. Seed from most of these sources were planted in the field to determine if behavior in the germinator is correlated with emergence, seedling vigor, and establishment in the field. From notes taken on seedlings this year, there appears to be a close correlation between vigorous seedlings in the germinator and good establishment in the field. This is the first year this approach has been tried and sufficient information has not been obtained to determine whether any progress can be made in obtaining better stands of sericea by this method.

Sericea plants observed for seedling vigor will also be evaluated for tannin content, leafiness, yield, etc., in order to attempt to combine these characters if a sericea is developed which can be established successfully.

At the present time no breeding work is being done at Ardmore with annual lespedeza. Various varieties are being tested on different soil types. Varieties of L. stipulacea are easier to establish and produce more forage than L. striata varieties.

Lespedeza Breeding in Arkansas, R. D. Staten, Fayetteville, Ark.

A. Current activities include:

1. Development of high forage and seed yielding strains of annual lespe-
deza with late maturity. Increase vigor and greater density so
that plants will be more able to compete with weedy vegetation in
spring.
2. An evaluation of bulk and pedigree methods of selection for forage
and seed yield.
3. An evaluation of plot sizes for testing selections of annual les-
pedeza.

B. Principal results (1954):

1. A study on the association of plant characteristics showed the
following correlations:

a.	Spread spaced plants - seed yield spaced plants	+.613
b.	" " " " " from plots	+.302
c.	" " " - forage yield from plots	+.501
d.	Seed yield spaced plants - seed yield from plots	+.321
e.	" " from plots - forage yield plots	+.403
f.	" " - date of flowering	-.440
2. Forage yields obtained from single- and multiple-row plots were
very similar, showing a positive correlation of +.662. Seed yields
obtained from single- and multiple-row plots were not signifi-
cantly correlated.
3. The modified bulk - pedigree method of selection was superior to
either the bulk or pedigree methods of selection, with the pedi-
gree method showing the least amount of increase in forage and seed
yields over the parental check varieties. It appears that a com-
bination of pedigree testing and concurrent phenotypic selection
will give the greatest genetic advance in selection for yield.
4. At present we have about 10 lines that have resulted from this work
that are now being tested and evaluated with known varieties.

Lespedeza Breeding in North Carolina, W. A. Cope, Raleigh, N.C.

A. Current activities include:

1. Development of a late maturing Korean with other characteristics
of Rowan lespedeza.
2. Studies on diploid and induced tetraploid forms of L. stipulacea
(annual), L. striata (annual), and L. cuneata (perennial) to (a)
determine their value per se as for plants, and (b) break ster-
ility barriers existing between diploid annual and perennial forms.

3. Evaluation of progenies from crosses between perennial species.
4. Isolation of root-knot nematode resistant lines of sericea.
5. Determine effects of inbreeding in sericea.

B. Principal results (1954.):

1. A quantitative study on the inheritance of forage and seed yield showed positive genetic correlations for forage yield and the following: Seed yield and date of flowering. Seedling vigor, however, was higher for earlier maturing lines. A higher value for heritability and a greater expected advance from selection were indicated for seed yield than for hay yield.
2. Induced autotetraploids of sericea did not show particular promise as forage plants. They were slightly higher in tannin and lower in CaO, P₂O₅, and K₂O than the diploid checks. Attempts to cross annual and perennial species by using diploid and induced tetraploid forms of each species failed, but the studies did indicate certain combinations in which embryo culturing might be successful.
3. Tests of selected root-knot resistant progenies of sericea showed without doubt that sericea is not immune to root-knot nematodes and that increased resistance to each of the root-knot species tested can be obtained from selection.

Progress Report on Sericea Breeding, J. M. Elrod, Ga.

A sericea breeding project was initiated at Experiment in 1945. Prior to that time, Stitt had reported that the tannin content in different sericea plants varied considerably.

The first year the tannin content of about 1200 sericea plants was determined. The percent tannin varied from 2.4% to 12.8%. Seed was harvested from approximately 10 percent of the plants having the lowest tannin content. These were planted in a head row nursery and tannin analyses were made two to four times annually for the next three years.

In 1949, plants from 60 rows having the lowest tannin content were transferred to a spaced-plant nursery. For three years, samples from individual plants were analyzed to determine the tannin content. Also, the plots were grazed by sheep and beef yearlings. The beef animals showed a preference for the low tannin plants. The sheep grazed everything.

In 1954, selected plants were transferred to a replicated spaced-plant nursery. Each plant was divided into four parts for the different replications. On account of dry weather, many of the plants were lost. We are trying to re-establish this nursery this year.

At the beginning of this work we found four selections which showed less than 5% tannin. We have been trying to get some seed increased of these. Unfortunately, low tannin is associated with low yield, lack of vigor, low plant height, etc. Seed of these selections have been sent to other workers.

Ga. 13 has short, small leafy stems. It matures earlier than common sericea.

Ga. 35 has stems of medium size and height and appears to be more vigorous than Ga. 13, with about the same tannin content.

Ga. 96 has coarser stems than Ga. 35 and they tend to spread rather than stand upright. It stays green and tends to hold its leaves until frost.

Ga. 102 has short, medium size stems. It is similar to Ga. 13, but is later maturing and has slightly higher tannin content.

Trifolium, Red, White, Crimson, P. B. Gibson, Ala.

Discussion Leader.

Discussion of red clover breeding for the Work Planning
Conference of Subproject II, Project S-12, N. L. Taylor, Ky.

Although red clover production differs considerably throughout the South, certain aspects of production and breeding are similar. The greatest production problem is that of longevity which is related to disease resistance, particularly to the root rots. In the Upper South, red clover is a weak perennial, whereas in the Lower South it frequently behaves as an annual. Powdery mildew is probably the leading foliar disease in the Lower South, but in the Upper South, southern anthracnose and *Stemphylium* leafspot are more important.

In the breeding of red clover, there are several important problems. These include: (1) Lack of genetic, physiological, and pathological information, (2) Lack of information on methods of breeding as related specifically to red clover, and (3) The fact that hybridization of red clover with other species in the genus *Trifolium* has not yet been accomplished.

At the present time, red clover breeding in the South, to my knowledge, is limited to the Florida, Louisiana and Kentucky Experiment Stations. At the Florida Station, the breeding of a powdery mildew resistant strain is underway. In Louisiana, methods of breeding are being investigated concurrently with the development of a disease resistant variety of greater adaptability. In Kentucky, three methods of breeding are being investigated: Recurrent selection in the breeding of Kenland, the southern anthracnose-resistant variety; the polycross method; and a type of strain building. As a background for the breeding program, fundamental genetic, pathological, and physiological studies are underway. In addition, the investigations of possible approaches to hybridization have been initiated.

In the future, certainly, fundamental studies must be continued and expanded. New approaches to old problems must be investigated. The root-rot problems must be solved. Perhaps a better approach to this problem rather than to inoculate with the weak aphthogens such as Fusarium, Sclerotium, Rhizoctonia, etc. would be to develop more vigorous plants either by recurrent selection or interspecific hybridization. When the plant is vigorous, it is resistant to these organisms, but when weakened by other diseases, drought, close clipping, and other factors, it succumbs. Likewise, new approaches to hybridization must be investigated. These may include pollen stimulation, embryo culture, embryo transplants, and hormones. In the future, the breeder probably will not be as much concerned with forage yield as with better quality of forage, higher yield of seed, disease resistance, longevity, and the development of clover for different uses such as pasture types and varieties with different maturity dates.

White Clover Breeding in Florida, E. S. Horner, Gainesville, Fla.

Summer survival is the primary objective of white clover breeding in Florida. Present varieties die out to a large extent by mid-summer, necessitating either natural or artificial reseeding each year. Seedlings do not become established quickly enough to give good winter grazing.

Our plan is to clone out individual plants which have lived through one summer for further testing. Clones which show some superiority will be allowed to intercross in isolation and another cycle of selection will be started. By such recurrent selection we hope to accumulate genes for resistance to diseases and other factors which influence survival.

At present twenty promising clonal lines have been established but have not yet been thoroughly tested.

White Clover Types and Persistency Studies, J. P. Craigmiles and L. V. Crowder, Ga.

For three years, data have been obtained from white clover (giant and intermediate types) on grass (Coastal Bermuda, Dallis, fescue) both irrigated and not irrigated trying to determine the factors involved in the persistency of white clover and the relative value of Ladino versus La. types. Notes were taken on profuseness of flowering, number of stolons, forage production, soil temperature and moisture.

By August the clover had disappeared from all plots not irrigated whereas it persisted well until September in the irrigated plots. When the forage yield data for clover alone was correlated with moisture and soil temperature it was found to be significantly related to both variables. Partial correlation indicated that the effect of temperature was independent of moisture and was effective in reducing growth regardless of the moisture.

Stolon rot severely damaged both clover types but was more severe on the intermediate types early in the spring and after profuse flowering. Following the stolon rot damage, dry soil conditions and high summer temperature caused the stolons to become desiccated and to die. If ample soil moisture is available the organisms causing the stolon rots continue growth and damage the plants but enough plant growth occurs so that the clovers persist and reproduce. Temperature on irrigated plots probably is important in the enhancement of the growth of the pathogens causing the stolon rots.

Continuing the above studies, a new series of plots will be established this fall to include the following variables: Moisture, temperature, clover type, grass and diseases. The disease variables will include a dust to control all diseases, a treatment specific for Rhizoctonia and a no control. Dr. E. S. Luttrell, pathologist at the Georgia Experiment Station, will cooperate.

Approximately 10,000 white clover spaced plants were established during the winter of 1952, using a wide range of genotypes collected over a period of years. In 1953, one hundred fifty were selected for further clonal evaluation. The severe freeze of March 1955, followed by drought, reduced this number considerably.

From the most promising remaining clones a narrow polycross will be established and strains synthesized for further testing.

White Clover Improvement in Alabama, P. B. Gibson. Auburn, Ala.

In our white clover improvement work we are emphasizing investigations of the reasons for the death of white clover plants. I shall mention some of these studies and shall use slides to present a brief progress report of this work.

<u>Variable</u>	<u>Results</u>
1. Flowering	Inducing a non-flowering white clover to flower by exposing to an extended light period lowered the persistence of the clover
2. Control of soil-borne organisms by fumigation	Fumigating Cahaba loamy fine sand increased the persistence of white clover growing on this soil.
3. Clipping to simulate grazing.	Clipping reduced the persistence.
4. Soil moisture	Irrigating increased the persistence
5. Soil temperature	Period of greatest damage to white clover followed high soil temperatures
6. Genotype	Genetic make-up of plants influences persistence e.g. sparse flowering plants persist longer than plants that blossom profusely.

7. Root pattern under plants By taking core samples of soil under plants and by use of tagged phosphorus we did not detect significant differences in the root systems under different white clovers
8. Diseases Stolon troubles are more important in the disappearance of white clover than leaf diseases

Additional Research Needed on Crimson Clover, W. E. Knight
and H. W. Bennett, Miss.

I. Establishment:

1. Moisture. Results of a date of planting experiment conducted for 3 years, indicate that moisture is the main factor in early establishment of crimson clover. This suggests the need for work on the use of irrigation in the timely establishment of crimson clover. Crimson clover planted on July 15, 1953, on a fallowed seed bed was the only seeding out of 15 to produce ^{sufficient} fall growth for grazing. Rain occurred every day for 9 days after the July 15 seeding, with a total of 2.88 inches. There was only 3.73 inches of rain from July 28 until December 3 and the summer and fall were the hottest and driest on record. The clover was sufficiently established that a stand survived.
2. Land Production. Failures to obtain stands have been common during recent dry years when complete seed bed preparation is made at planting time. Successful stands have been obtained when land previously fallowed is lightly harrowed before seeding and cultipacked immediately after seeding.

II. Plant Selection:

Wide variations have been observed between spaced plants for size, number of stems and vigor. Does this offer possibilities for selecting superior lines or is it merely heterosis?

Slide #2. Note variation in size of widely spaced plants. A heavy application of inoculum was used and the plots were watered to establish.

Slide #3. Additional evidence of plant variation.

III. Hard Seed:

Combined seed of our so-called hard seed varieties contain 5-10% hard seed. Therefore, the farmer does not have the benefit of the hard seed characteristic in the establishment year. Would it be desirable to attempt to raise the hard seed content of this seed? If so, is it a breeding or processing problem or both?

1:30 P.M. Joint Session - Report from chairmen of various sessions to joint session regarding the present status of research and needs for research in the areas of Breeding, Technique, Environmental Factors and Seed Production.

Seed Production - E. D. Donnelly, Ala., Chairman

Summary of Research on Subproject IV which is concerned with Seed Production, Harvesting, Processing and Storing,
E. D. Donnelly, Ala.

Richards (Tenn.) reported that preharvest applications of desiccating herbicides on crimson clover in 1953 and 1954 caused no significant differences in yield, moisture content, germination or hard seed content. Orchardgrass results showed no significant differences in yield or moisture content for either year. Differences in germination were not significant in 1953, however, in 1954 seed from the Endothal and PCP treated plots had significantly higher and significantly lower germination, respectively, than seed from check plots.

Bunch, Mississippi, reported that the two years' data indicates that moisture content of the top growth of crimson and white clovers was significantly reduced by Endothal to facilitate direct combining. Results from other materials tested varied from year to year or were unsatisfactory. Desiccation of the top growth of these two crops had no influence on the viability of the seed immediately after harvest or after the seed had been stored for 10 months. The more effective desiccants significantly reduced the percentage of hard seed in crimson clover and (with the exception of oil soluble Dinitro) in white clover. The survival and regrowth of white clover plants were not affected by the treatments.

Greenhouse data reported by Bennett (Miss.) on the response of three crops of varying photoperiods and temperatures indicated the following: Dallisgrass failed to produce seed heads when grown under 8-hour and a normal day. Seed head production under a 12-hour day was erratic and flowering incomplete. A high night temperature and a 14-hour photoperiod appears to provide the most desirable environment for greenhouse production of Dallisgrass seed. Low night temperatures inhibited seed head formation in Dallisgrass under long day. Results with Bahia were similar to those with Dallisgrass. Normal and 12-hour day lengths produced highest yields of Johnson grass seeds. These results suggest allowing Johnson grass to mature late in the growing season for maintenance of rootstocks since forage yields would be reduced by the short days at this time and seed yields would be higher if field response is the same as under greenhouse conditions.

Crimson clover grown under 6 temperatures and 6 photoperiod treatments flowered best under low night temperatures and normal day length. Seed shattering in Dallisgrass increased with maturity and it was concluded that in order to get maximum seed yields a modified system of harvesting is needed. A harvester utilizing a shaker or shaker-suction should result in seed of superior quality as compared to combine or windrow harvesting.

E. C. Holt (Texas) reported that studies of the influence of climatic factors and cultural practices on seed production of Dallisgrass indicated that the lower the maximum temperature and the higher the minimum humidity, the better the seed set within the range of conditions encountered during the period from June to September in Texas.

Holt also reported that early applications of N increased the June seed crops consistently and significantly. A second application of N (June) has reduced the second seed crop significantly. There has been some tendency for the spring N application to reduce the percentage of caryopses in the seed material. Since seed quality is best in the spring, before June 15, a spring application of N (up to 60 pounds N in these studies) is profitable.

Results of studies on orchardgrass and tall fescue were reported by W. W. Woodhouse (N. C.). It was found that 100 pounds of N applied in February gave most consistent high seed yields. Higher rates and split applications did not give significant increases.

Burns (Ga.) set forth the most suitable storage conditions for lupine seed: Combine with as low cylinder speed as possible to get the mature seed; dry immediately to 12% moisture or less; store seed under conditions that will maintain 12.5% moisture or less. Lupine seed stored under these conditions maintained satisfactory viability for three years or more.

Ward (Ala.) reported results of research on storage of crimson clover, sericea lespedeza and fescue seed indicated that these seed must be stored with relative humidity of less than 75% to prevent decline in viability. Highest germination after 6 months of storage was for seed held at 54% relative humidity. Equilibrium moisture content of these seed under this relative humidity were 10.1, 8.1, and 11.2% respectively.

Results of this test also indicated that satisfactory viability of crimson clover seed may be maintained for one year at 65% humidity, while 54% humidity is necessary to maintain viability for three years. It was concluded that storage of seed for more than two years without humidity and temperature control is not possible in the Southeastern United States.

Digest of Techniques Sessions, H. L. Lucas, N. Car.

1. We know considerable about the specific roles played by the various techniques employed in pasture research.

- (i) Agronomic small plots can tell us about growth characteristics of forage species and mixtures, and about the reaction of swards to management and fertilizer practices (including reaction to grazing), especially as regards yield, botanical composition and persistency of stand). They also can be used to provide information on palatability and digestibility of forages by grazing the plots or by feeding forage clipped from them.

- (ii) Cage and mower-strip methods provide a tool for measuring forage consumption and the nutritive value of what is consumed, the latter by correlation of consumption with animal performance. They also provide information on the production and reaction of swards under grazing.
- (iii) The digestion indicator methods provide information regarding consumption and nutritive value as do cages and mower-strips, and in addition provide information on digestibility per se. They do not provide data on sward production and reaction except very indirectly.
- (iv) The role of palatability and animal behavior studies seems more uncertain than the role of other techniques. It seems to be generally conceded, however, that they provide important information on forage quality from the standpoint of how much of a forage an animal will consume and the degree of selectivity if the animal is grazing swards of mixed species. The latter is important in recommending sward mixtures and management procedures.
- (v) The grazing trial is the one technique which can provide directly an overall outcome measure. In the grazing trial all the animal and plant forces and the environmental forces and the environmental forces acting on animal and plant operate as an integrated whole. In contrast, the other techniques are adapted to studying various facets of pasture and animal behavior. Since present knowledge does not permit integration of data on the various facets except in an uncertain manner, the grazing trial plays a very important role.

2. Even though the role of the various techniques seems pretty well clarified, a number of problems exist concerning details of applying the techniques and especially in integrating the data obtained by the various techniques.

- (i) In using agronomic small plots to study palatability and effects of grazing on the sward there arise questions regarding plot size, numbers of animals to use, frequency of grazing and length of time to leave animals on plots. Although an investigator can state what he did regarding plot size and the other factors, and can express opinions as to the goodness of what he did, it seems that studies particularly devoted to answering these questions are needed.
- (ii) Although high correlations between performance and cage and mower strip results have been observed (one particularly encouraging paper was read at these sessions), high correlations are not the rule. Just why the correlations are high sometimes and are low other times is not clear. Perhaps the techniques are not standard between investigators, but it seems that this is not the only matter. Characteristics of the forage, of the pastures and of the animals may also be involved.

(iii) Although the digestion indicator methods show considerable promise and much has been learned from their use, improvement in them seems necessary. Depending on how they are used, various errors can be serious, e.g. errors due to diurnal fluctuations in fecal composition and errors in the relation assumed to exist between digestibility and fecal composition. Another limiting factor is that the consumption and digestibility of individual components of a mixed sward can not be estimated; estimates are obtained only for the total forage.

(iv) In the grazing trial results can be affected by many factors. Outside of factors such as size of experimental pastures, the use of put-and-take grazing, etc., which need additional study, it is evident that results can be markedly affected by type of animal and by grazing pressure. Certainly, if results are to apply to a specific situation, the type of animal used must be chosen accordingly. The problem of grazing pressure is a difficult one, however. In many instances stocking rate is regulated by the investigator such that the pasture is grazed at an intensity he considers to be "optimum". Objective criteria for deciding what is "optimum" are needed. Of interest also is the problem of interpreting grazing trials under western range conditions where it appears that about as much if not more forage may be consumed by rodents, game and insects than is consumed by the cattle.

3. Particularly critical seems to be the development of new techniques or the refinement of current techniques, to provide measures which the forage breeder may use as bases for selection, and which the agronomist may use for his various purposes prior to the grazing-trial stage of evaluation. It is generally accepted that dry matter yield and disease and insect resistance are not sufficient and there is considerable question about the value of measurements such as protein content. Measures are needed which predict with some degree of reliability the amount of the forage or of components of the forage that an animal will consume under specified conditions, and will predict the nutritive value of the consumed forage. Particularly interesting items discussed along this line were:

- (i) the use of leaf-stem ratio as a criterion for selection
- (ii) small-plot palatability studies as an aid in selection
- (iii) considerations of ration balance in terms of how the forage may be used, e.g. with or without supplemental feeding, with beef cattle or with dairy cattle.
- (iv) use of the artificial rumen
- (v) the need for recognizing and learning to measure toxic factors and factors involved in bloat.

4. The need for the team approach was emphasized several times in the course of the papers and discussions. Judged as particularly important by some was the need for top-notch chemists to learn about the chemical make-up of the plant, so that better measures of quality might eventually be developed.

Dr. Chamblee called the group to order. The status of this conference and that of the Southern Pasture and Forage Crops Technical Committee S-12 was discussed. It was pointed out that the objectives of the two organizations were essentially identical, although completely separate. It was generally agreed that the programs of the Southern Pasture and Forage Crop Improvement Conference, if developed along the lines of the four main sub-projects of the S-12, would benefit the members of the S-12 project. It was also pointed out that the programs of the Southern Pasture and Forage Crop Improvement Conference need not be limited only to S-12 active projects.

Chairman Chamblee called attention to the two invitations from State College, Mississippi, and Experiment, Georgia, as meeting places next year. A motion was made by G. W. Burton (Ga.) that the preference of the group be obtained by a show of hands. The motion was seconded by E. C. Holt. A majority of the conferees voted to hold the conference at Experiment, Georgia, in 1956.

The secretary was instructed to write Dean McLeod of the Tennessee College of Agriculture, University of Tennessee, expressing our appreciation to him for the excellent arrangements and facilities provided for this conference.

Dr. Chamblee then turned the meeting over to Dr. R. E. Blaser, Chairman for the coming year.

Dr. Blaser asked that a vote of thanks be taken to express to Dr. Chamblee and his associates on the committees our appreciation for the excellent program. A vote of thanks was also extended to Dr. Mott and the Purdue delegation for their contribution to the program.

Chairman Blaser announced the appointment of W. B. Anthony, Ala., as chairman of the Pasture Evaluation Techniques session for next year and C. H. Hanson, N. Car., as chairman of the Forage Crops Breeding session. Chairmen of other sections would be appointed later.

There being no further business to come before the conference, the meeting adjourned.

Southern Pasture and Forage Crops Improvement
Conference

Registration List - 1955

Allison, J. Lewis	Raleigh, N. C.	N. C. Agric. Expt. Station
Anthony, W. Brady	Auburn, Ala.	Ala. " " "
Ayers, Thos. L.	Washington, D. C.	A.C.P. Service, USDA
Barrentine, B. F.	State College, Miss.	Miss. Agric. Expt. Station
Bashaw, E. C.	College Station, Tex.	Tex. " " "
Bates, R. P.	Ardmore, Okla.	Samuel Roberts Noble Found.
Beaty, Elvis R.	Athens, Ga.	Univ. of Ga.

Registration List (cont.)

Bennett, H. W.	State College, Miss.	Miss. Agric. Expt. Station
Blaser, R. E.	Blacksburg, Va.	Va. " " "
Brinkley, R. M.	Raleigh, N. C.	N. C. " " "
Bunch, H. D.	State College, Miss.	Miss. " " "
Burns, R. E.	Experiment, Ga.	Ga. " " "
Burton, G. W.	Tifton, Ga.	Coastal Plain Expt. Station
Chamblee, D. S.	Raleigh, N. C.	N. C. Agric. Expt. Station
Chance F. S.	Knoxville, Tenn.	Tenn. " " "
Cook, E. D.	Temple, Tex.	Tex. Substation No. 5
Counce, E. W.	Martin, Tenn.	Univ. of Tenn.
Craigsmiles, J. P.	Experiment, Ga.	Ga. Agric. Expt. Station
Davis, R. L.	Lafayette, Ind.	Ind. " " "
DeVane, E. H.	Tifton, Ga.	Coastal Plain " "
Dickson, Lewis	Knoxville, Tenn.	Tenn. Agric. " "
Dobson, J. W. Jr.	Blairsville, Ga.	Ga. Mountain " "
Dobson, S. H.	Raleigh, N. C.	N. C. Agric. " "
Donnelly, E. D.	Auburn, Ala.	Ala. " " "
Earhart, R. W.	Clemson, S. C.	S. C. " " "
Elder, W. C.	Stillwater, Okla.	Okla. " " "
Elrod, J. M.	Experiment, Ga.	Ga. " " "
Engel, R. W.	Blacksburg, Va.	Va. " " "
Erdman, L. W.	Beltsville, Md.	Soils & Plt. Rel. Sect., ARS
Ewing, John	Knoxville, Tenn.	Tenn. Agric. Expt. Station
Fergus, E. N.	Lexington, Ky.	Ky. " " "
Forbes, Ian, Jr.	Tifton, Ga.	Coastal Plain " "
Gibson, P. B.	Auburn, Ala.	Ala. Agric. " "
Gibson, R. H.	Knoxville, Tenn.	Tenn. " " "
Gilbert, W. B.	Raleigh, N. C.	N. C. " " "
Graf, G. C.	Blacksburg, Va.	Va. " " "
Graumann, H. O.	Beltsville, Md.	Forage & Range Sect., ARS
Hanson, C. H.	Raleigh, N. C.	N. C. Agric. Expt. Station
Harlan, J. R.	Stillwater, Okla.	Okla. " " "
Hein, M. A.	Beltsville, Md.	Forage & Range Sect., ARS
Henderson, James	Saginaw, Mich.	A. T. Ferrall Co.
Henson, Lawrence	Lexington, Ky.	Ky. Agric. Expt. Station
Henson, P. R.	Beltsville, Md.	Forage & Range Sect., ARS
Hill, D. L.	Lafayette, Ind.	Ind. Agric. Expt. Station
Hodges, E. M.	Ona, Fla.	Range Cattle Expt. Station
Hogg, P. G.	Stoneville, Miss.	Delta Branch " "
Holt, E. C.	College Station, Tex.	Tex. Agric. " "
Horner, Earl	Gainesville, Fla.	Fla. " " "
Huffine, W. W.	Stillwater, Okla.	Okla. " " "
Jarman, Edgar	Blairsville, Ga.	Ga. Mountain " "
Jeffers, R. L.	Jay, Fla.	West Fla. " "
Langford, W. R.	Auburn, Ala.	Ala. Agric. " "
Lewis, R. D.	College Station, Tex.	Tex. " " "
Lucas, H. L.	Raleigh, N. C.	N. C. " " "
Luck, H. W.	Nashville, Tenn.	Agron. Ext., P.O. Box 419
Lush, R. H.	Knoxville, Tenn.	Tenn. Agric. Expt. Station
Koch, C. R.	Cincinnati, Ohio	Farm Quarterly, 22 W. 12th. St.
Mott, G. O.	Lafayette, Ind.	Ind. Agric. Expt. Station
Matthews, J. N.	Nashville, Tenn.	Agron. Ext., P.O. Box 419
McCloud, D. E.	Gainesville, Fla.	Fla. Agric. Expt. Station

Registration List (Cont.)

McCullough, M. E.	Experiment, Ga.	Ga. Agric. Expt. Station
McIlvain, E. H.	Woodward, Okla.	Okla. " " "
Merrill, Gene	Gulfport, Miss.	Allied Chemicals, 1102 Cecille St.
Mills, W. R.	Kampola, Uganda	Kawanda Agr. Res. Sta., Box 265
Mondart, C. L. Jr.	Baton Rouge, La.	Univ. Expt. Station
Neel, L. R.	Nashville, Tenn.	Farm & Ranch Magazine
Odom, J. N.	Knoxville, Tenn.	Tenn. Agric. Expt. Station
Osborne, T. S.	" "	" " "
Paden, W. R.	Clemson, S. C.	S. C. " " "
Pendergrass, W.	Knoxville, Tenn.	Tenn. " " "
Prine, G. M.	Tifton, Ga.	Coastal Plain " "
Reed, H. E.	Knoxville, Tenn.	Tenn. Agric. " "
Remmenga, Elmer	Lafayette, Ind.	Ind. " " "
Rhodes, Gilbert	Knoxville, Tenn.	Tenn. " " "
Rivera-Brenes, Luis	Rio Piedras, P. R.	P. R. " " "
Sell, O. E.	Experiment, Ga.	Ga. " " "
Shoulders, J. F.	Blacksburg, Va.	Va. " " "
Simons, H. M. Jr.	Atlanta, Ga.	Farm Journal, 429 Grant Bldg.
Skold, L. N.	Knoxville, Tenn.	Tenn. Agric. Expt. Station
Smart, W. W.	Raleigh, N. C.	N. C. " " "
Smith, H. C.	Knoxville, Tenn.	Tenn. " " "
Staten, R. D.	Fayetteville, Ark.	Ark. " " "
Stroube, W. H.	Lexington, Ky.	Ky. " " "
Summerour, C. W.	Montgomery, Ala.	American Potash Inst.
Taylor, N. L.	Lexington, Ky.	Ky. Agric. Expt. Station
Templeton, W. C. Jr.	" "	" " " "
Turner, Bernie	Saginaw, Mich.	A. T. Ferrell Co.
Underwood, J. K.	Knoxville, Tenn.	Tenn. Agric. Expt. Station
Wells, H. D.	Tifton, Ga.	Coastal Plain " "
Woodhouse, W. W. Jr.	Raleigh, N. C.	N. C. Agric. " "
Wylie, C. E.	Knoxville, Tenn.	Tenn. " " "